

## Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.



Reserve  
A280.29  
F22I

U. S. DEPT. OF AGRICULTURE  
NAT. BUREAU OF PLANT INDUSTRY

NOV 4 1970

CURRENT CATALOG RECORDS

A detailed botanical line drawing of an alfalfa plant. It features a central stem with several pairs of trifoliate leaves. At the top of the stem is a large, rounded terminal flower head. A smaller, similar flower head is shown on a separate stem at the bottom left. The background of the illustration area has faint, wavy horizontal lines.

# *Guidelines for* **COOPERATIVE ALFALFA DEHYDRATING PLANTS**

FCS INFORMATION 68  
FARMER COOPERATIVE SERVICE • U.S. DEPARTMENT OF AGRICULTURE

Farmer Cooperative Service  
U. S. Department of Agriculture  
Washington, D. C. 20250

Farmer Cooperative Service strengthens the economic position of farmers and other rural people by improving organization, development, management, and operation of their cooperatives. It works directly with cooperative leaders and Federal and State agencies on cooperative problems. It publishes research results and educational materials and issues the *News for Farmer Cooperatives*.

The Service helps (1) farmers and other rural residents get better prices for products they sell and obtain supplies and services at lower cost; (2) rural residents use cooperatives to develop and make effective use of their resources; (3) cooperatives improve their services and operate more efficiently; (4) members, directors, employees, and the public to better understand how cooperatives work and benefit their members and their communities; and (5) encourage international cooperative programs.

## Preface

Much of the information for this publication came from a study of alfalfa dehydrating operations jointly conducted by the Farmer Cooperative Service (FCS), U. S. Department of Agriculture, and Montana State University. Data were obtained from 30 selected dehydrating plants in various parts of the United States.

Cooperative dehydrating concerns were included in the plants sampled. FCS staff also interviewed former officials at 10 locations where cooperative plants had closed operations. Former managers, directors, and farmer-members of the plants provided helpful information on the reasons for the plants' failure. County agents of long residence in the area also contributed information about the closed plants.

In addition, correspondence in FCS files that contained information on most of the closed plants was examined.

Other sources of information, including published data and unpublished research, were also reviewed.

The information presented here has been developed from these sources into practical guidelines that cooperatives and others can use in establishing an alfalfa dehydrating plant.

## Contents

<b>Highlights . . . . .</b>	<b>iii</b>
<b>Alfalfa dehydrating industry . . . . .</b>	<b>1</b>
Development and growth . . . . .	2
Appraisal of cooperative dehydrating . . . . .	7
<b>Physical considerations . . . . .</b>	<b>11</b>
Environment for growing alfalfa . . .	11
Alfalfa characteristics . . . . .	13
Characteristics of dehydrating process . . . . .	15
<b>Economic considerations . . . . .</b>	<b>22</b>
Investment and working capital . . .	22
Production and marketing costs . . .	25
Prices . . . . .	32
Sales proceeds and net returns . . .	33
Break-even analysis . . . . .	33
Markets and market development . .	34
<b>Industry problems . . . . .</b>	<b>37</b>
Excess carry-over . . . . .	38
Changed feed mixing practices . . .	38
Excess capacity . . . . .	40
Production and marketing uncertainties . . . . .	40
Prospects through 1970-71 . . . . .	40
<b>Guidelines for establishing alfalfa     dehydrating cooperatives . . . . .</b>	<b>42</b>
Alfalfa supply and market . . . . .	42
Location . . . . .	42
Initial financing . . . . .	42
Plant efficiency and stability . . . .	43
Management team . . . . .	44
<b>Appendix . . . . .</b>	<b>46</b>
<b>Literature cited . . . . .</b>	<b>48</b>

## Highlights

This publication gives guidelines for those interested in dehydrating alfalfa as a feed ingredient and feed supplement.

Many segments of American enterprise and several foreign countries have requested such information. Among them were: (1) farmer cooperatives, and groups of farmers considering a new cooperative, (2) individuals contemplating such a business venture, (3) general business corporations, and (4) private and public agencies working on economic development, especially in rural areas.

Successful cooperative dehydrating plants may benefit grower-members by increasing prices received for their alfalfa or by supplying dehydrated alfalfa to cooperative feed mills at cost. They also benefit the community where they are located by providing outlets for raw material, fuel, utilities, and labor resources.

Dehydrated alfalfa—known as dehy in the industry—is in demand because of the availability and usefulness of its nutrients. It primarily goes into manufactured feed, but a growing number of livestock feeders use it as a separate feed.

The dehydrating process removes moisture rapidly from fresh alfalfa. In effect, it makes pastures portable and storable. The process was developed to prevent nutrient losses associated with field curing.

The industry has grown steadily in both production and sales volume. The number of plants dehydrating alfalfa reached a peak of about 500 in 1950, but has since declined to about 300.

Many types of firms are included in the dehydrating industry—individually owned operations, partnerships, investor-oriented corporations, and cooperatives. Cooperatives have not participated in large numbers because of (1) the seasonal uncertainty of supply and demand which causes high risks, (2) high investment requirements, and (3) farmer reluctance to commit a definite supply of alfalfa. Currently, 10 cooperative plants are operating.

Experiences of cooperatives and other types of plant ownership in dehydrating operations have been similar. Most cooperative plants that have closed did so because of factors outside their operations. Only a few closed because of incapable management.

Because of considerable changes in dehydrating technology over the years, plants and production have had to be relocated. This shift has affected both cooperative plants and other types of firm ownership.

Prospects for cooperative or other types of dehydrating plants depend heavily on good growing conditions for alfalfa. Alfalfa has some charac-

teristics that encourage dehydrating but others that impose limits on how the process can take place. Environmental conditions influence these characteristics.

Dehydrating requires careful coordination of activities over a relatively wide geographic area. The size of a proposed plant depends on how much alfalfa is available within an economical hauling distance. Central location to alfalfa supply should receive high priority in selecting a plant site.

It takes a substantial investment to establish a plant. The amount depends on size of plant and whether facilities are new or used.

Operating costs differ from one location to another and from year to year even at the same location. Average costs are lower in Nebraska and Kansas than elsewhere in the United States.

Break-even analysis, using various cost-return relationships, helps to determine the prospects for success of a proposed plant and may be especially useful in determining an amount to borrow for financing the project.

The product dehy is competitively priced. Developing a market for a new dehydrating plant's output requires a good selling job, especially by a marketing cooperative.

Cooperators getting into dehydrating should be aware of industry problems which include: (1) inventory carry-over, (2) changed feed mixing practices, (3) excess capacity and (4) perennial uncertainty.

A brief outline of suggestions for establishing a cooperative dehydrating facility includes these points:

(1) Carefully investigate cost and return ratio for proposed enterprises. Determine if enough product can be sold at the right prices to give adequate net returns; supply of raw

product; investment requirements and operating costs; competition in area; and capacity indicated by alfalfa supply and quantity of meal to be sold—whichever is smaller.

(2) Choose a good location that is centrally located to alfalfa supply to reduce hauling costs. The site should offer inexpensive fuel and adequate shipping facilities.

A desirable surrounding area should have fertile, well drained soils; adequate moisture from irrigation or subterranean sources; relatively mild temperatures; and a season long enough for three or four cuttings.

(3) Provide sufficient funds to pay for facilities and to carry operations through the first year. Additional capital could be made available by selling preferred stock to members.

(4) Organize plant for efficiency and stability. Be certain of growers' intentions to grow alfalfa over a long period. Have enough members so that default by any one grower would not seriously impair operations.

Fields averaging 20 acres or more in size and within a 10-mile radius of the plant are preferable.

Have an agreement between growers and the cooperative that defines possible areas of conflicting interests.

(5) Select a capable management team. The director must have the ability to reconcile his farm interests and those of other member-growers with the long term objectives of the dehydrating plant.

The manager should be someone who has demonstrated managerial ability. His qualifications will depend in part on whether the cooperative is a marketing agency formed by alfalfa growers or a supply agency established by a feed manufacturing cooperative. The first requires a manager with an interest in selling; the latter a production oriented manager.

# Guidelines for Cooperative Alfalfa Dehydrating Plants . 1

by Charles E. Reed  
New Services Division

This publication discusses how to determine whether or not to establish an alfalfa dehydrating plant. It sets forth the physical and economic conditions needed for successful operations.

Requests for information about establishing such plants have come from almost all sections of the United States and several foreign countries.

Those requesting such information represented many segments of American enterprise. Among them were: (1) farmer cooperatives, and groups of farmers considering a new cooperative, (2) individuals contemplating such a business venture, (3) general business corporations, and (4) private and public agencies seeking means for rural areas development.

## Alfalfa Dehydrating Industry

Dehydrating alfalfa is the process of rapid removal of moisture from freshly cut and chopped alfalfa (chops). Approximately 4 tons of wet chops are required to produce one ton of dehy—a term the industry has adopted to set the product apart as a unique feedstuff. The conversion to a dry meal occurs through direct exposure to intense artificial heat.

Further processing includes grinding, pelletizing, and treating with an antioxidant. Certain markets may require regrinding the product and blending it to specifications. Some meal may be stored, but specialized storage facilities are needed to maintain quality.

The standard market grade of dehy is 17 percent protein and 100,000 units of vitamin A. Material below

and above the standard may be marketed for specific purposes.

Dehy is used as an ingredient for livestock and poultry feeds throughout the United States and in a number of foreign countries. It is especially useful where forage may be of poor quality. It is a natural source of proteins, vitamins, and minerals. It contains pigments, including Xanthophyll, reproductive and survival agents, and unidentified growth factors.

A major portion of dehy produced in the United States goes into manufactured feeds. The majority of poultry formulas contain dehy. An increasing amount goes directly to livestock feeders for use as a mix in rations or as a feed supplement.

The industry's installation of pre-



Alfalfa is being cut, chopped, and blown into a trailer as one operation. Approximately 4 tons of this wet chopped alfalfa are required to produce one ton of dehy—an industry term to identify the product as a unique ingredient for live-stock and poultry feeds.

servative storage capacity is nearly half the annual production volume. Such storage makes high quality dehy available to users long after the major producing season ends. Recently, disappearance of dehy from November to April equalled that from May to October.

### Development and Growth

The alfalfa dehydrating industry has developed in size and technology typical of most industries. A period of experimentation preceded actual commercial activities. Commercial production began in the early 1930's but developed slowly through the depression years. During the 1940's, the industry expanded rapidly. It reached a stage of relative maturity in the late 1950's.

\* Industry growth, in terms of volume of production and disappearance, has been relatively continuous. Since

1948, annual production gains have occurred 15 times; decreases from the preceding year have occurred four times (table 1). The gains resulted mostly from adding to industry capacity. Setbacks were mainly caused by adverse weather conditions.

Since 1948, sales volume has increased 13 times and decreased 6 times. During the 1967-68 season, disappearance was approximately 2 times greater than during the 1948-49 season. Of the 1,514,200 tons of dehy about 164,000 tons were exported.

### Plant Capacity

Before 1950, additional new plants were the reason for increased annual production in the industry. After 1950, the industry's annual production continued to increase, but with fewer plants. Construction of larger plants and existing plants operating

at high capacity caused the larger output.

Increased plant capacity came about in several ways. Some plants added a drier or complementary equipment to existing facilities. Sometimes the addition was purchased new, but frequently it was obtained from a plant that had closed.

With the development of larger drying units to supplement or replace smaller ones, a number of new plants, including a cooperative, began operations with these high capacity units.

The improved production-capacity ratio in the dehydrating industry can be attributed to the experience operators have gained. Thus they can use the facilities to better advantage. In addition, there has been a shift in the geographical concentration of operations to areas better suited to growing alfalfa for dehydrating.

Several plants produce more than 35,000 tons of dehy annually. About

two dozen, however, produce less than 1,000 tons a year. Average annual production for each plant during the 1966-67 season was 5,500 tons.

### Number and Location of Plants

The total number of plants established since dehydrating became a commercial activity is estimated at between 900 and 1,000. About 30 cooperative dehydrating plants were established during the same period. Currently about 300 plants dehydrate alfalfa in this country, including 10 cooperatives.

The number of dehydrating plants in the United States has risen and declined over the years. An estimated 100 plants were operating in 1941 (5).<sup>1</sup> A fairly complete inventory listed 185 establishments in 1944, including 6 cooperatives (2). In 1950, it was estimated that more than 500 alfalfa dehydration plants were in operation (9). A relatively

Currently about 300 plants dehydrate alfalfa in the United States, including 10 cooperatives. Here a truck loaded with fresh alfalfa waits for unloading space at a plant feeder. Loss of nutrients is rapid in the fresh material, thus, preventing stock-piling.



Table 1.—Dehydrated alfalfa production and disappearance, 1948–49 to 1968–69 seasons

Season May 1–April 30	Production		Disappearance	
	Tons	Percentage change from previous year	Tons	Percentage change from previous year
	Thousand	Percent	Thousand	Percent
1948–49	732.0	—	709.1	—
1949–50	800.3	9.3	820.3	15.7
1950–51	907.5	13.4	906.6	10.5
1951–52	846.5	–6.7	851.6	–6.1
1952–53	1,020.1	20.5	968.8	13.8
1953–54	855.6	–16.1	899.6	–7.1
1954–55	1,063.7	24.3	1,002.7	11.5
1955–56	1,163.7	9.4	1,135.9	13.3
1956–57	962.3	–17.3	1,036.1	–8.8
1957–58	1,110.7	15.4	1,064.5	2.7
1958–59	1,122.9	1.1	1,167.0	9.6
1959–60	1,171.6	4.3	1,143.2	–2.0
1960–61	1,242.0	6.0	1,122.3	7.0
1961–62	1,277.9	2.9	1,265.3	3.4
1962–63	1,317.8	3.1	1,293.8	2.3
1963–64	1,437.5	9.1	1,409.1	8.9
1964–65	1,575.0	9.6	1,565.3	11.1
1965–66	1,596.7	1.4	1,658.5	6.0
1966–67	1,660.2	4.0	1,650.4	–.5
1967–68	1,620.9	–2.4	1,514.2	–8.3
1968–69	1,582.4	–2.4	1,655.9	9.4

Source: Dehydrated Alfalfa Production and Disappearance, American Dehydrators Association, 1969.

complete listing in 1954 identified 348 plants, of which 14 were cooperatives (8). The number of plants established after 1944 and ceasing operations before 1954–55 is not known. Apparently, the number was substantial and included both cooperative and other type organizations.

The number of cooperative dehydrating plants in the industry has always been small, ranging between 3 to 4 percent of the total.

Generally, cooperative and other

type plants have had similar survival and discontinuance experiences. For example, 57 percent of the cooperatives and 59 percent of the other firms operating in 1954 had discontinued operations by 1965.

#### Industry Structure

About 200 firms now operate dehydrating plants—an average of nearly 1½ plants each. A limited number of firms each operate more than 20 plants at various locations. The majority, however, have only one plant.

Industry production is concentrated

<sup>1</sup> Figures in parentheses refer to literature cited, page 48.

among firms. Twenty percent produce more than 70 percent of annual tonnage. Approximately 54 percent of the firms contribute only 12 percent of the industry production. Firms producing less than 1,000 tons annually represent about 12 percent of the total number of firms but only 1 percent of the total production volume.

About three-fourths of the alfalfa dehydrating plants in operation are investor-oriented corporations. The remaining fourth are partnerships, individually owned firms, and cooperatives. At least one plant is operated by a religious organization.

### Types of Business Organization

Investor-oriented corporations in the alfalfa dehydrating industry consist of owner-operated plants and those that have hired managers.

The owner-operated concerns are generally family enterprises or partners who choose to incorporate. They differ little, if any, from individual ownerships and partnerships in operations.

Those that have hired managers include the industry's large firms. These differ among themselves in that: (1) several have many owners while others have a few, (2) some are organized solely or mainly to dehydrate alfalfa, but others are part of a larger organization whose principal business is not dehydrating, and (3) two or three are multiplant firms, while others operate rather large-scale operations at one site.

Individual ownerships and partnerships among dehydrating organizations are usually small. They include plants operated for many years by original owners. The presence and persistence of these types of organization demonstrate how easy it has

been to enter the industry, even with limited capital, and the ability of small plants to compete.

Cooperatives have several operations of substantial size and a few relatively small ones. Two general types of cooperatives are: (1) those organized by growers as marketing outlets for their alfalfa, and (2) those added to feed mixing cooperatives—the larger group.

### Technological Advances and Product Improvement

Developments in the alfalfa dehydrating industry include both technological advances and product improvements. Because of mechanical innovations, an activity that formerly required a lot of labor has become highly automated. Machines used in harvesting, processing, and storage are specialized and require intelligent, skillful operators for their proper and efficient operation. Generally, these innovations have resulted in higher labor productivity and lower labor costs per ton of output.

But they have also complicated the problem of recruiting, training, and retaining a labor force at many plants. Personnel must be capable of handling a first-rate, full-time job, but dehydrating usually provides only part-time, seasonal employment.

Product improvement has been steady and continuous. It has been induced by the exacting demands of dehy users and aided by research, innovations, and accumulated industry experience.

Before 1950, the main concern in dehydrating was production. Following 1950, buyers became more aware of their own need for a quality material. Through selection, they encouraged product improvement and, in so doing, the techniques of production. Dehydrators who did not adopt these



Machines used in harvesting, processing, and storage of alfalfa are specialized and require intelligent, skillful operators. Here an operator is checking the feeding of chopped alfalfa into the dehydrator to assure a controlled flow consistent with the moisture content of the chops and the internal temperature of the drum for uniform drying.

improved production techniques went out of business.

The dehy industry competes with other sectors of the feeds industry; it must satisfy increasingly stringent feed requirements. Research, ranging from alfalfa improvement through utilization of the finished product, has helped dehy to maintain a preferred status among users. Better timing of activities and speedier processing, which enhanced quality, have been accomplished through innovations. New techniques and improved equipment have transformed the physical properties of dehy from a dusty, dangerous material into an easily handled product.

Technological advancement and product improvement in the industry have not run their course. A persistent criticism against dehy, especially in poultry feeds, has been its relatively high fiber content.

Research to find an economical way of reducing fiber and thereby increase the protein and carotene content of the product seemingly has been successful and put into practice on a small scale. A method that separates the alfalfa leaf from the stem during processing has been developed through a cooperative effort by the U.S. Department of Agriculture, Western Utilization Research and Development Division, and the Nebraska Department of Economic Development.

The technique results in a low fiber, rich quality material. Depending on perfecting the new procedure and on solving the marketing problems involved, widespread adoption of fractionating may take place.

Available evidence indicates that type of business organization (including the management involved) neither hinders nor facilitates adopting innovations and improving quality.

## Trade Association

The industry has organized the American Dehydrators Association, Kansas City, Mo., as its trade association. This organization sponsors a broad program of research and promotional activities. It awards grants to agricultural experiment stations throughout the United States to study feeding properties of dehy. Results of compared feeding trials have been especially useful in promoting the use of dehy in a variety of feeds.

The association publishes a weekly bulletin that provides members with current market information and other news of interest to the industry. It also distributes relatively complete statistics on production, disappearance, (including exports) and prices.

In addition, the organization publishes an annual membership directory that includes a guide to suppliers of dehydrating equipment.

Each year the American Dehydrators Association holds a convention to elect new officers. At these events specialists talk to the membership on new developments in the production and use of dehydrated alfalfa. Convention proceedings are published.

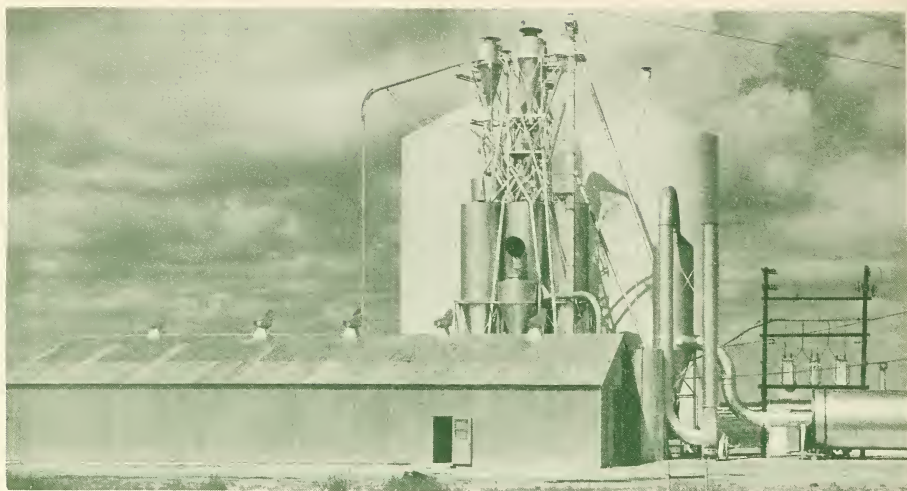
The American Dehydrators Association has memberships in 13 countries outside the United States.

## Appraisal of Cooperative Dehydrating

Answers to the questions in this section have been given by cooperators currently or formerly associated with alfalfa dehydrating, and knowledgeable observers of cooperative dehydrating.

### What Are Cooperative Dehydrating Benefits?

The 10 cooperative dehydrating



An alfalfa dehydrating plant such as shown here is advantageous to the community in which it is located. It uses local resources including fuel, utilities, and labor.

plants now operating appear to be well established. Members of cooperatives benefit from such sustained operations as does the community where the plant is located.

Alfalfa growers who operate their own cooperative dehydrating plant receive a premium price for their crop. Including patronage refunds, their price per ton ranges from 15 to 30 percent above that of growers in the same area who sell to other dehydrators.

Dehydrating alfalfa plants operated by cooperative feed mixing concerns supply the ingredient at cost. This is consistently below market price and often the saving is substantial.

In addition, the cost of producing dehy is much more stable than its market price. By operating their own dehy facility, cooperatives have a relatively assured supply of the ingredients, and this simplifies their inventory and financial planning.

A cooperative dehydrating plant

may benefit others in a community besides its members. Cooperative managers reported that the higher prices they paid grower-members for alfalfa raised prices for other growers who marketed to other dehydrators in the area.

A dehydrating plant is advantageous to the community in which it is located. It uses local resources including raw material, fuel, utilities, and labor.

Net returns from sales belong to plant owners. If ownership is held outside the community, these net returns flow out of the local economy. If ownership is held by residents of the community, net returns represent income to them and most of this is spent locally. The more widely ownership is held, as in a cooperative, the larger the proportion of the net returns likely to be spent in the home community. Cooperative ownership of a dehydrating plant is thus more advantageous to the local economy than other forms of ownership.

## Why So Few Cooperative Dehydrating Plants?

A variety of reasons given for the comparatively small number of cooperative dehydrating plants. Some of the more frequent responses were:

1. Alfalfa dehydrating is too risky a business for cooperatives. Plants have been closing too frequently in too many places over a long period of time for this trend to be overlooked.

2. The amount of investment by each co-op member is too high. For the limited number of cooperators to be served, the cost of establishing a plant has been more than for most other cooperative activities. The high cost and evident riskiness of such a venture has made such an operation unattractive to cooperatives.

3. It is difficult to get farmers to cooperate in providing a dependable supply of alfalfa. Generally, alfalfa is grown primarily to benefit other farm enterprises—cash crops, livestock, or both. The farmer's principal interest is the crop or livestock in which he specializes, and alfalfa is secondary. Under this circumstance he may be reluctant to commit himself to alfalfa on a long-term basis.

4. Farmers grow alfalfa for various reasons—as a rotation crop, as a suitable alternative when conditions (that is, prices) for other cash crops are unsatisfactory, and others. Many dropped rotation practices in favor of commercial fertilizers and reverted to their original crops when conditions improved. This shifting from alfalfa production has been a major cause of discontinuances for all types of dehydrating plant ownerships.

5. Quantity of dehy needed to fill the requirements of a feed cooperative is small compared to its total output of feed. In most cases a dehydrating plant can supply more of the ingre-

dient than the cooperative can use in its feed mixes. Under such circumstances, the cooperative has to sell its surplus dehy in a highly competitive market.

## What Caused Cooperative Plants to Stop Operating?

The 20 cooperative dehydrating plants discontinued operations for a variety of external and internal reasons. The study showed these reasons:

1. Eight plants (40 percent) closed because of external problems associated primarily with the physical environment. These plants would have been forced to close regardless of their type of business organization or quality of management. In one area where four cooperative plants discontinued operations, about 24 other (2 dozen proprietary) plants also closed.

2. Six plants (30 percent) succumbed to a combination of external and internal problems. They operated under marginal environmental conditions which often resulted in a short supply of alfalfa. Internal deficiencies reflected the unwillingness or inability of management to set aside part of the proceeds from good years to tide the plants through difficult years.

3. Four plants (20 percent) closed because of an apparent voluntary internal decision to do so. Their physical environments were favorable. They had good operating records. The decisions to get out of dehydrating did not appear to be forced.

4. Two plants (10 percent) went out of business because of poor management. They operated under favorable environmental conditions.

Specific causes for cooperative dehydrating plants discontinuing operations included both physical and economic conditions. These were:

### A. External-Physical

1. Too much moisture for extended periods of time. This interrupted operations which lowered production and increased costs, caused poor quality product, prevented adopting innovations, and discouraged alfalfa growers.

2. Drouth over extended periods of time. This reduced yield and quality of alfalfa and increased harvesting costs.

3. Floods, followed by inability to obtain new stands of alfalfa.

4. Too short a season causing low production and high overhead costs.

### B. External-Economic

1. Depressed prices for dehydrated alfalfa which resulted from excellent growing conditions and production in excess of market requirements.

2. Technological changes. In some cases these resulted in techniques to which plants could not adapt or took away advantages plants had relied upon.

For example, the introduction of a shorter cutting rotation to get better quality of dehy found some plants unable to adopt the practice because of frequent interruptions from rainfall.

Also, plants located south of the major producing areas of Nebraska and Kansas depended largely on their ability to market early when prices were at their high winter and early spring levels. The introduction of inert gas storage and fast expansion of storage capacity evened out the winter-spring price spread to a point where the southern plants lost their advantage.

3. Resource problems such as dwindling alfalfa acreage, high utility costs, and limited availability of

skilled labor. Automation increased labor productivity and considerably raised the technical skill required of workmen.

### C. Internal-Physical

1. The main internal physical cause for discontinuing cooperative dehydrating operations was destruction of facilities by fire. By itself, this may not have been sufficient to force a permanent closing. However, since management did not have a financial program which allowed for such a contingency, fire was the evident cause of terminating operations.

### D. Internal-Economic

1. Unwise patronage refund policies—too frequent and too large an amount.

2. Unwillingness of management to adopt technological improvements.

3. Grower-members changing from alfalfa to other crops. This would be an external factor for other than cooperative concerns.

4. Inability of grower-members as policy making directors to transfer sufficient interest from their individual farm enterprise to the cooperative operations.

As growers, they want to cut their alfalfa at a relatively advanced stage of maturity to get more tonnage. Some growers want their fields cut regardless of how small their acreage or how far they may be located from the plant, thus increasing the expenses of dehydrating.

5. Weak marketing efforts. Cooperatives that were not careful about the quality of their product had to accept discounted prices. Those without adequate storage had to sell at distressed prices rather than being able to wait for price improvement. Cooperative and other firms have marketed dehy much the same as feed grains and hence have accepted a going price for the product.

## Physical Considerations

Regardless of the type of business organization involved, a critical factor in evaluating the feasibility of a proposed agricultural marketing or processing facility is the availability of a commodity to be processed or marketed. It must be available in sufficient and consistent volume to support the facility over time. The quality must meet users' requirements. Labor and the necessary utilities must be available.

For dehydrating, these requirements must be evaluated in light of: (1) the conditions for growing alfalfa, (2) characteristics of alfalfa, and (3) the flow of material from field through processing.

### Environment for Growing Alfalfa

Alfalfa can adapt to a wide range

of environmental conditions. However, results vary depending on soil, moisture, and temperature relationships as well as length of growing season.

### Soils

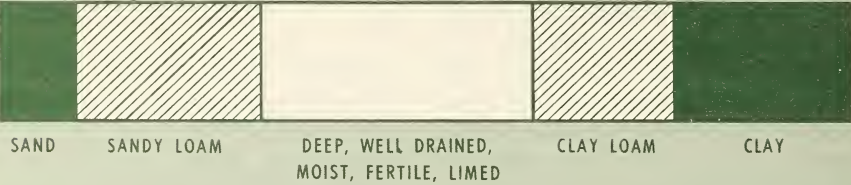
Alfalfa grows in soils ranging from light sand to heavy clay. It does best on very fertile soils that are deep, well drained, moist, and abundantly supplied with lime. Sandy soils generally lack the fertility and moisture holding capacity needed to provide an adequate yield and consistent supply of alfalfa required for satisfactory dehydrating operations. Clay soils also lack fertility, but they hold moisture too long and therefore are unsuitable for growing alfalfa for dehydrating.

Alfalfa can adapt to a wide range of environmental conditions. Shown here is an alfalfa field ready for harvest. Results vary depending on soil, moisture, and temperature relationships as well as length of growing season.

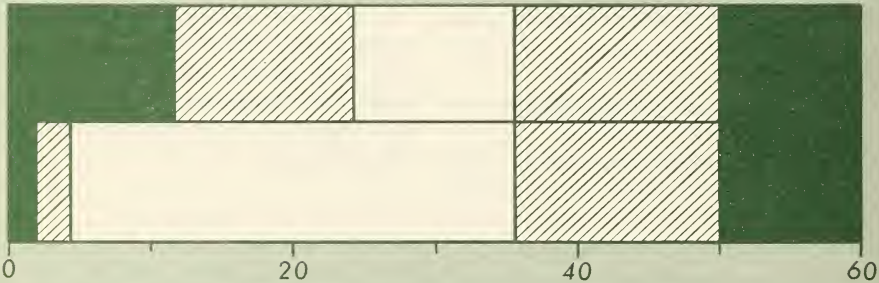


**FIGURE 1.--RATED CONDITIONS OF SOIL, MOISTURE, TEMPERATURE AND LENGTH OF SEASON FOR GROWING ALFALFA FOR DEHYDRATING**

**SOIL (TYPE)**



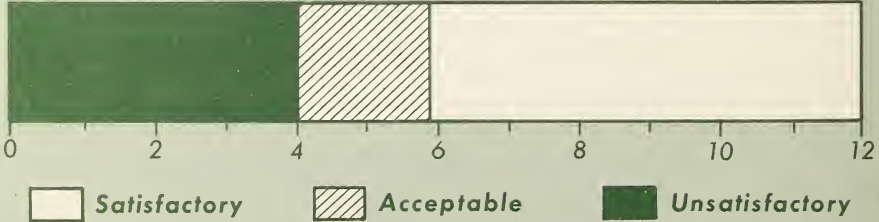
**MOISTURE (INCHES) (Precipitation or irrigation)**



**TEMPERATURE (DEGREES F.)**



**LENGTH OF SEASON (MONTHS)**



Satisfactory
  Acceptable
  Unsatisfactory

Moisture

Alfalfa uses about 800 pounds of water to produce one pound of dry material (1). It grows best under semi-arid conditions with moisture supplied from underground sources or by irrigation. When precipitation is the main source of moisture, crop yields vary. The supply of moisture may sometimes be too little and sometimes too much. Rainfall during the dehydrating season interrupts operations when fields become muddy.

Best conditions for dehydrating purposes range from 25 to 35 inches annual rainfall with adequate amounts during the season to promote growth, but not so heavy or of such duration as to interrupt field operations excessively. Rainfall requirements become less important as the quantity of water supplied by irrigation increases.

Temperature

Alfalfa tolerates wide temperature ranges. Best growth occurs between 70° and 90° F. It suffers under continued exposure to temperatures above 100° F. especially if water is not available in adequate quantity. Growth is slow during cool weather.

Length of Season

Alfalfa grows in seasons of variable length. When grown for dehydrating it is important to have a sufficient number of cuttings to cover overhead costs. Under prevailing cost-price relationships, the acceptable lower margin is about three cuttings. Between four and five cuttings are generally the minimum for satisfactory operations.

Figure 1 is a guide prospective organizers of a facility can use to determine whether alfalfa growing

conditions in their area are suitable for dehydrating purposes. Alfalfa grows well at times under conditions designated by dark areas (4). It grows well most of the time but with occasional to frequent problems under conditions designated by shading (2). Light areas (1) specify relatively problem-free conditions suited for growing alfalfa for dehydration.

Using the guide to appraise a local set of conditions, requires making value judgments. Since soil, moisture, and temperature patterns tend to gradual differences, it is difficult to draw a clear-cut line between desirable and undesirable conditions.

One method is to assign weights on the basis of deviations from the most favorable conditions. For example, a deep rich soil might be given a weight of 1, clay soils a weight of 4, and intermediate soils a weight between 1 and 4. Slightly heavy soils, or those with hardpan, might be given a weight of 2, and heavy soils weights ranging from 2 to 4. Uncertainty whether a soil is 1 or 2 may be settled by using 1½ as its weight.

The same method can be used in evaluating moisture (either precipitation or irrigation, but not both), temperature, and length of season. The total weight given all factors will provide a fair estimate of dehydrating possibilities on the following basis:

Satisfactory	5 or less
Marginal	6
Unsatisfactory	7 or more

Alfalfa Characteristics

Certain characteristics of alfalfa provide opportunities that make dehydration possible; others limit or prescribe dehydrating methods (fig.2).

## **FIGURE 2.-- ALFALFA CHARACTERISTICS THAT PROVIDE OPPORTUNITY FOR DEHYDRATING, AND LIMIT OR PRESCRIBE METHODS IN DEHYDRATING**

- 
1. Provides feed as forage for livestock
  2. Provides fertilizer for other crops in a rotation system
  3. Provides several harvests annually for a period of years from one seeding
  4. Nutrients are concentrated in leaves of this plant
  5. Maturing process decreases leaf-stem ratio, but strengthens alfalfa for regrowth after harvesting
  6. Alfalfa rapidly loses valuable nutrients after being cut

### **A. OPPORTUNITY ELEMENTS**

1. Alfalfa performs its fertilizing functions efficiently enough to permit the sale of some cuttings during a season to dehydrators.
2. Alfalfa feed factors (except Vitamin D) survive intense heat of short duration and thus permit dehydrating which in turn opens up a new market for either excess forage or that grown specifically for sale.
3. Several cuttings annually on the same land permit dehydrating operations to continue throughout an extended season and for a number of years.

### **B. LIMITING ELEMENTS**

4. The need for a quality dehydrated product limits the harvesting of alfalfa to a period of high nutrient concentration; i.e., when the plant as a whole is composed mostly of leaves.
5. In maturing, the stemmy portion of alfalfa grows faster than its leafy portion thus lessening the nutrient concentration of the whole plant. Harvesting at early maturity provides quality, but shortens the life of the alfalfa stand. Harvesting at the immediate pre-bloom to 1/10 bloom stage delivers high quality material and enables the stand to survive indefinitely.
6. Alfalfa may lose half its carotene and xanthophyll within three hours after harvesting, thus limiting the allowable time interval between cutting and dehydrating.

The opportunity elements may be disadvantageous from the viewpoint of prospective dehydrators. For example, when alfalfa is part of a rotation system, it benefits the soil best if left in place instead of being harvested. Thus occasions arise when a cutting or two during the season is not sold for dehydration.

Similarly, when alfalfa supports a feeding operation, the need for a grower to serve his own purposes may prohibit selling one or two cuttings to the dehydrator. In either case, withholdings tend to occur on late cuttings when yield is down and the dehydrating establishment is urgently seeking raw material.

The limiting elements require: (1) careful timing of harvesting operations, and (2) immediate conversion of raw material into dehy.

### Characteristics of Dehydrating Process

Alfalfa dehydrating originated as a means of preventing the nutrient losses associated with field curing.

#### Material Flow

Various activities associated with a dehydrating plant may occur over a rather wide geographic area (fig. 3). Problems of communications and supervising personnel often occur in integrating these dispersed operations.

*Harvesting.*—Harvesting alfalfa consists of cutting, chopping, and blowing fresh alfalfa into a towed vehicle (usually a trailer) in a single operation, and transferring the load to a truck.

Factors influencing time required to cut a load are yield of alfalfa (tons per acre) and conditions, size, and shape of the field. Number of cutting machines must be increased or decreased to compensate for these

factor variations to maintain an even flow of alfalfa for transfer to a truck.

*Trucking.*—Trucking portion of the dehydrating operation consists of receiving the load of fresh cut alfalfa from the trailer and hauling it to a processing site for unloading.

Factors determining length of time between hauls are distance between field and plant. Road and traffic conditions must be considered. As these conditions change, the number of trucks in operation must be increased or decreased accordingly.

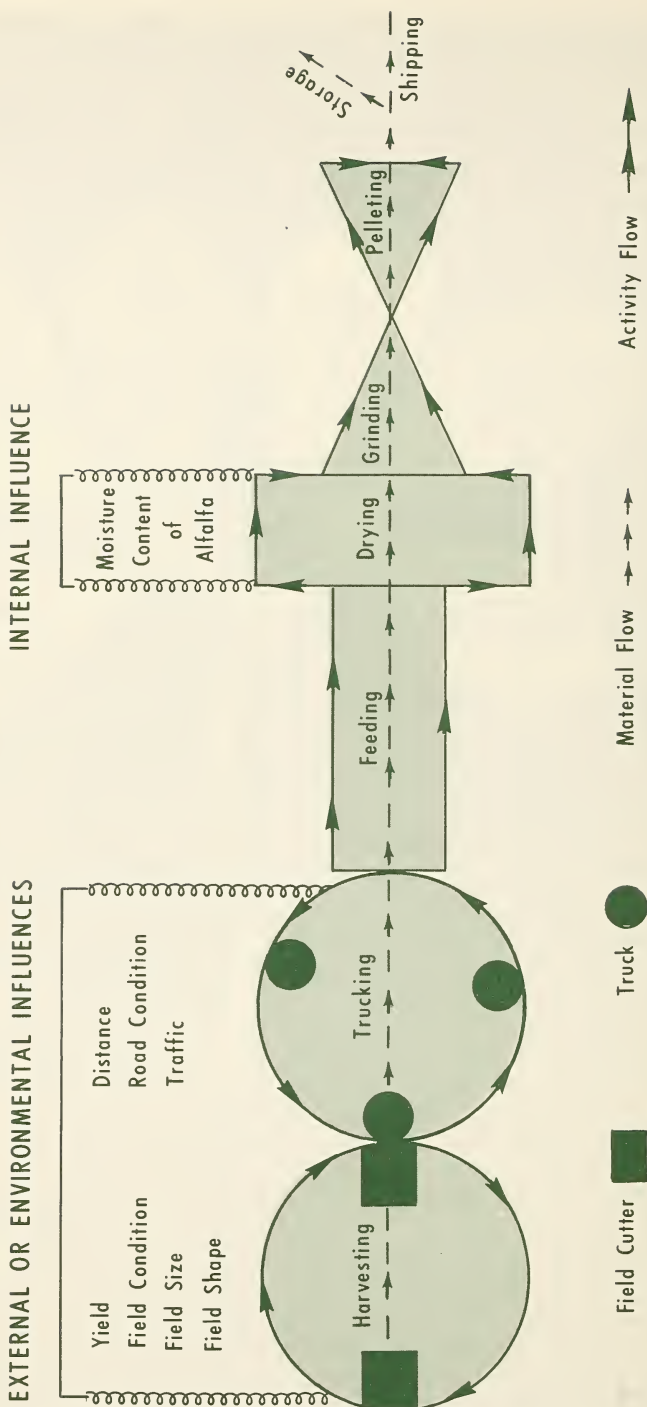
*Processing.*—Automatic feeding, drying, grinding, pelletizing, and treating alfalfa meal are elements of the dehydrating process at the plant.

In drying, material flow is relatively continuous but variable in rate. Rate variation, and occasionally stoppage of material flow, results when deliveries of raw material to the plant are slow or stop temporarily. Even when an adequate and constant supply of fresh chops is fed into the dryer, output fluctuates because wet alfalfa varies in moisture content from one load to another, and the drying unit can only remove a relatively constant amount of water in a given period of time.

Dehydrators are rated according to the amount of water they remove in an hour. Capacity ranges from about 6,000 to 36,000 pounds an hour. The dry output associated with rated capacity depends on moisture content of fresh alfalfa.

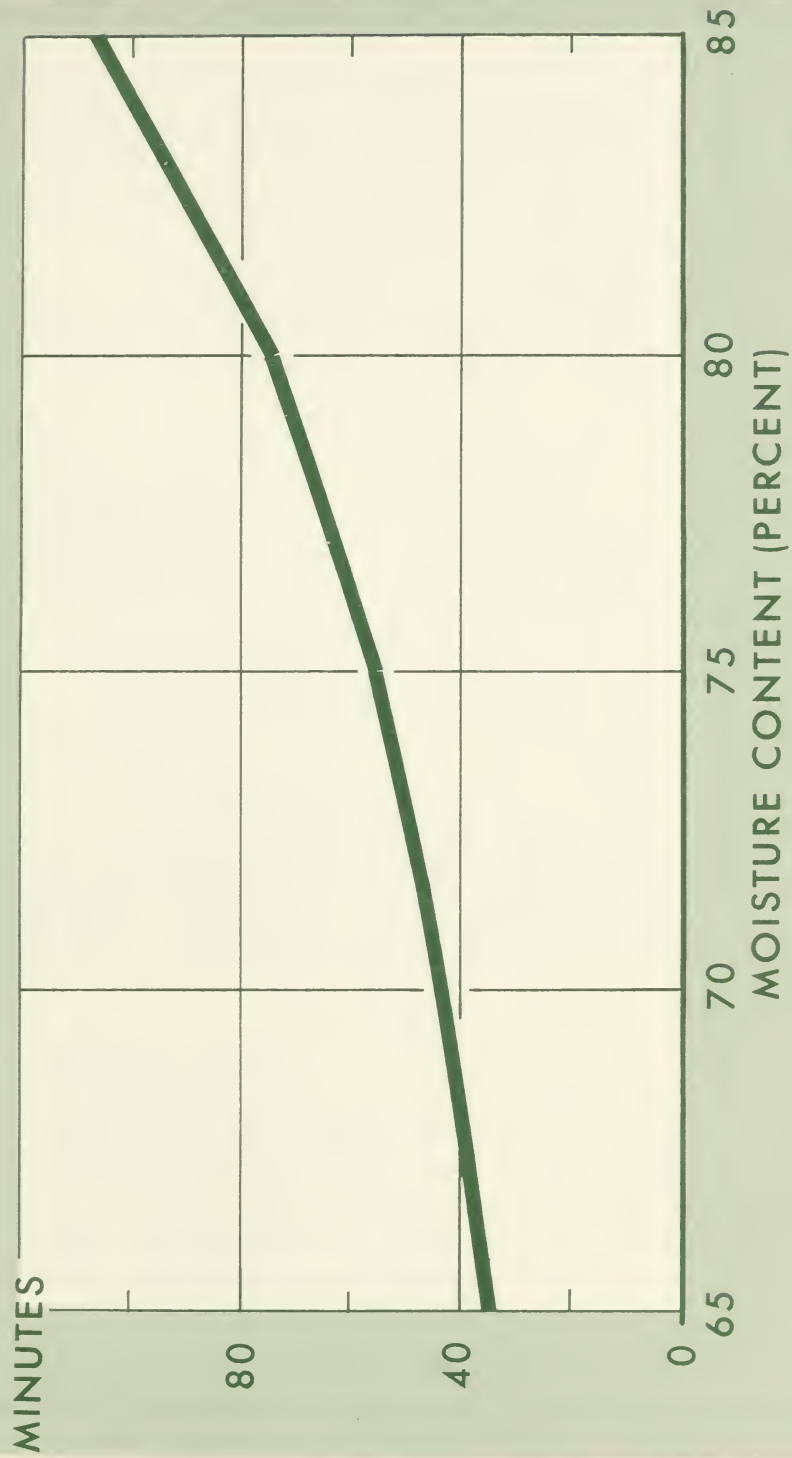
A 6,000-pound dryer produces  $1\frac{3}{4}$  of dehy an hour from chops containing 65 percent moisture and about  $\frac{1}{2}$  ton an hour from material containing 85 percent moisture. Average hourly production under usual conditions of 70-75 percent moisture for this size dryer is  $1\frac{1}{4}$  tons. Thus the length of time required to produce a ton of dehy varies considerably

**FIGURE 3.--MATERIAL AND ACTIVITY FLOW  
IN ALFALFA DEHYDRATING OPERATIONS\***



\* AND FACTORS THAT INFLUENCE RATE OF FLOW WITH EQUIPMENT OF GIVEN CAPACITY.

**FIGURE 4.--TIME REQUIRED TO PRODUCE  
A TON OF DEHYDRATED ALFALFA\***



\* WITH A 6,000 POUND DRYER AT VARIOUS MOISTURE CONTENTS.

**Table 2.—Alfalfa acreage needed to maintain production at No. 1 cutting level, Kansas, 1963**

Cutting No.	Land harvested	Average yield per acre	Dry weight produced	Land needed to sustain production at No. 1 cutting level
	Acres	Tons	Tons	Acres
1	1,095	.97	1,062	1,095
2	1,133	.80	906	1,327
3	947	.60	568	1,770
4	911	.42	383	2,529
5	833	.30	250	3,540

at different moisture levels (fig. 4).

Shutdowns of varying duration occur because of failures in alfalfa delivery to the automatic feeder, equipment breakdowns, and during replacements of parts to the grinder and the pellet mill. Temporary storage bins allow operations to continue while knives in the hammer mill and rollers and dies in the pellet mill are being replaced (fig. 5).

#### Determining Drying Capacity

A general practice in the industry is to install drying capacity based on peak load periods. Alfalfa is usually most abundant during the early cutting of the season. The main considerations of alfalfa supply as related to plant capacity are: (1) yield per acre, (2) acreage available and (3) number of days between harvest (cutting rotation) on the same field.

The needed drying capacity is determined by daily output potential from available alfalfa supply as shown below.

For example, table 2 shows 1,095 acres available for the first cutting. Yield is estimated at 1 ton an acre.

Using 27 days as an average, daily output is computed as follows:

$$\frac{1 \times 1,095}{27} = 40 \text{ tons a day}$$

Dividing daily output by the number of operating hours a day, which in most cases will be 24, results in an output of 1.6 tons an hour.

Since a 6,000-pound dryer produces a minimum of 1 ton of dehy an hour under usual conditions, the minimum capacity required to produce 1.6 tons an hour is determined as follows:

$$6,000 \times 1.6 = 9,600 \text{ pounds evaporative capacity an hour}$$

Generally the nearest capacity available above this minimum figure would be selected; for example, a 10,000 or possibly a 12,000 pound dryer.

The capacity of other equipment such as the hammer mill and pellet mill, is determined on a different basis. With these items of equipment the objective is to guard against bottlenecks occurring when dry output is relatively high.

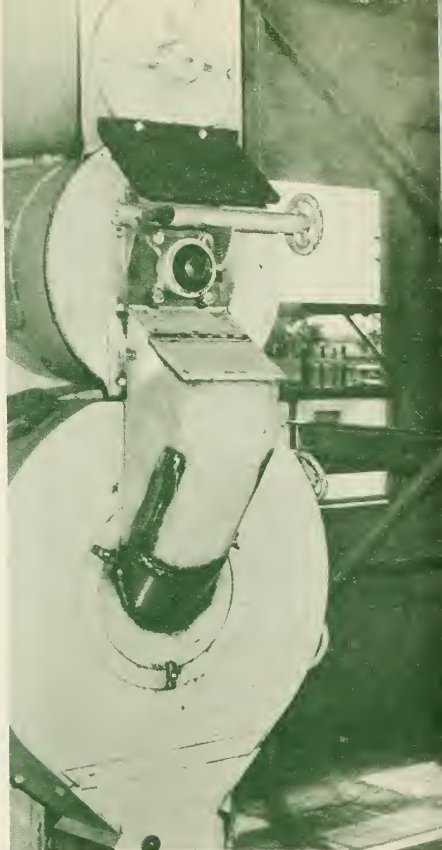
For example, 6,000 pound dryer with a usual dry production of 1-1¼

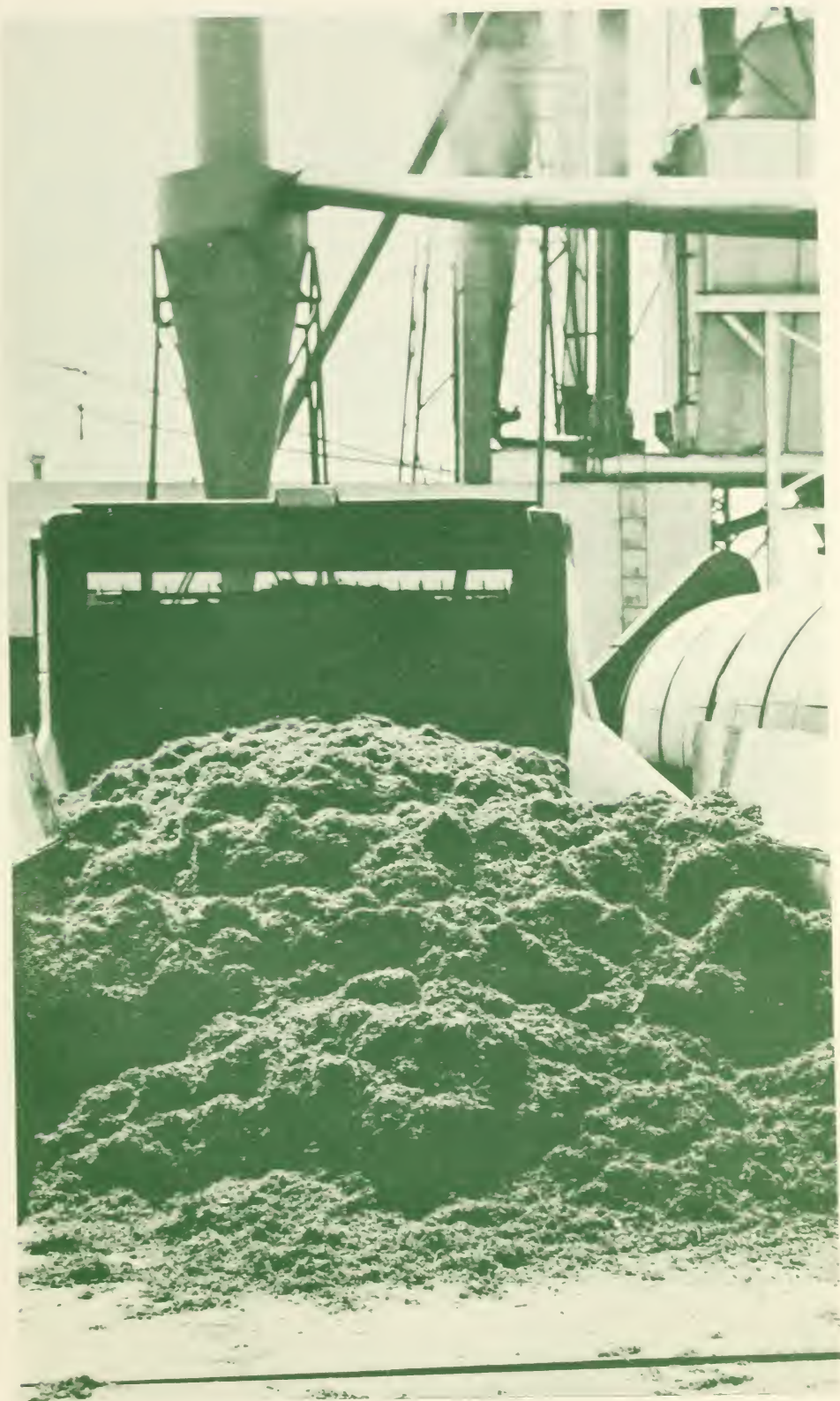
#### Formula For Drying Capacity

$$\text{daily output (dry tons)} = \frac{\text{yield per acre (dry tons)} \times \text{number of acres available}}{\text{number of days in cutting rotations}}$$



Elements of the dehydrating process at the plant are automatic feeding, drying, grinding, pelletizing, and treating alfalfa meal. Chopped fresh alfalfa in the forage feeder (facing page) ready to be fed into the dehydrator. Once in the dehydrating drum (below) water is removed rapidly from the wet chops. For ease of handling, storing, and transporting, dehy is pelletized and temperature reduced in a cooling tower (right) to slow down loss of nutrients.





tons an hour can produce at least 1½ tons an hour when alfalfa is relatively dry. To take advantage of such occasions, capacities in both hammer mill and pellet mill need to be adjusted accordingly.

The size and number of field cutters will depend mainly on plant drying capacity and alfalfa yield. The size and number of trucks will again depend on plant capacity and distances the fresh alfalfa must be hauled. Usually, because of variable environmental conditions, standby cutters and trucks will be needed.

If drying facilities, other plant equipment, field cutters, and trucks are to be purchased on the basis of yields obtained from cutting level No. 1, additional acreage will be needed as the season progresses. Table 2 illustrates how to calculate additional acreage requirements.

### Site Selection and Plant Layout

The raw material used in dehydrating is 4 to 5 times heavier and considerably bulkier than the finished product. These conditions dictate locating the plant near the center of alfalfa supply. Harvesting operations

should usually occur within a 5 to 10 mile radius of the plant, but may occasionally extend greater distances.

Additional vital considerations in selecting a site are fuel supply and transportation facilities.

Because it is convenient, clean, and economical, natural gas is used most often for dehydrating. However, fuel oil and liquified petroleum (LP) are used successfully.

Access to shipping facilities are required if the finished product is to be transported out of the area. Selecting a plant site along-side a railroad may mean locating away from the center of alfalfa supply. However, it is considerably more expensive to haul the heavier, bulkier fresh chops than the pelleted product. Although extra handling of the pelleted material is involved, a few operators believe it is more economical to locate in the center of alfalfa supply and truck the finished product several miles to a railroad.

A compact plant layout provides easy access to the major items of equipment and instrument panels. This makes it possible for one employee to handle operations at a relatively small plant.

## Economic Considerations

The economic feasibility of a proposed enterprise depends on a favorable cost-return relationship. This relationship can be determined by a detailed study of estimated capital requirements, production costs, marketing expenses, and net returns.

### Investment and Working Capital

Table 3 shows a detailed break-

down of land, equipment, structures, accessory items, and working capital to be considered in establishing a new facility. Blank spaces are provided for filling in estimated costs in view of local conditions and size of proposed plant.

As a guide to filling in the blanks, cost estimates are shown for a plant having a capacity of 3 to 4 tons an hour. This size plant was chosen as an example because the trend

is toward installing larger capacity plants, and it is of moderate size under current conditions.

## Land

Land on which to construct facilities varies in cost according to locality. The site needs to be large enough to avoid over-crowding and to provide for possible expansion — per-

haps three to five acres. Because dehydrating plants discharge dust into the atmosphere, locations away from populated areas are preferred.

## Field and Hauling Equipment

Major field and hauling equipment are: (1) cutters or choppers, (2) trailers, and (3) trucks with special beds.

**Table 3.—Estimated investment and working capital required for alfalfa dehydrating plant with 18,000 pounds evaporative capacity an hour (3 to 4 tons dry output), 10,000 tons a season**

Item	Estimated total cost range of typical plant	Local situation
	Dollars 7,000 - 8,000	Dollars
Land		
Field equipment		
Harvesting and hauling		
Cutters (self-propelled) (3)	43,000 - 45,000	
Trailers (3)	10,000 - 12,000	
Trucks with hoist (5)	27,500 - 32,500	
Total	81,000 - 89,500	
Plant equipment		
Dehydrating		
Rotary drum dryer	23,000 - 26,000	
Dump platform	4,000 - 4,500	
Automatic forage feeder	8,000 - 9,000	
Burner, tube and plate	5,460 - 6,600	
Drag conveyor	1,500 - 1,900	
Trunnion bases (2)	4,500 - 4,500	
Drum drive	3,300 - 3,700	
Vacollector with airlock	3,600 - 4,050	
Fan (suction)	3,600 - 4,000	
Gas control, rock trap, pipe and discharge stock	4,300 - 4,790	
Total	61,260 - 69,040	
Grinding		
Hammermill	6,800 - 7,450	
Product collectors	1,350 - 1,500	
Fan (suction)	990 - 1,080	
Pipe, transitions and frame	2,430 - 2,680	
Total	11,570 - 12,710	

(continued—)

**Table 3.—Estimated investment and working capital required for alfalfa-dehydrating plant with 18,000 pounds evaporative capacity an hour (3 to 4 tons dry output), 10,000 tons a season—(continued)**

Item	Estimated total cost range of typical plant	Local situation
<b>Pelleting</b>	<b>Dollars</b>	<b>Dollars</b>
Pellet mill	20,000 – 22,000	
Surge bin	3,200 – 3,600	
Feeder (screw type)	4,700 – 5,200	
Bucket elevator	7,800 – 8,600	
Scalper	1,700 – 1,950	
Cooler and tower	8,900 – 9,800	
Dust collector and stack	1,500 – 1,700	
Automatic scale	1,750 – 1,900	
Conveyor (screw type)	950 – 1,045	
Pipes, transitions, fittings	2,975 – 3,290	
<b>Total</b>	<b>53,475 – 59,085</b>	
<b>Pellet Transfer</b>		
Pump, pipe, support	7,850 – 8,600	
<b>Total</b>	<b>7,850 – 8,600</b>	
<b>Buildings and storage</b>		
<b>Mill building and accessories</b>		
Building with foundation	23,000 – 25,500	
Steam system	7,000 – 7,800	
Electrical system	42,180 – 46,130	
<b>Total</b>	<b>72,180 – 79,430</b>	
<b>Storage</b>		
Tanks with foundation	40,000 – 45,000	
Gas generating system	13,000 – 14,500	
Conveyors	4,000 – 4,500	
<b>Total</b>	<b>57,000 – 64,000</b>	
<b>Installation, painting, and construction</b>	<b>26,180 – 28,800</b>	
<b>Total</b>	<b>26,180 – 28,800</b>	
<b>Grand total—investment</b>	<b>377,515 – 419,165</b>	
<b>Working capital</b>	<b>40,000 – 60,000</b>	

#### Plant Equipment

Major components of plant equipment are: (1) forage feeder, (2)

dryer, (3) blowers, (4) cooling cyclones, (5) hammer mill, (6) boiler system, (7) pellet mill, (8) pellet cooling tower, and (9) devices for



Trucks with special beds unload freshly cut alfalfa into forage feeder. This type of truck or trailer is the major hauling equipment used to transport the raw material from the fields to the dehydrating plant.

moving pellets to storage or shipment.

Manufacturers' prices for dryers are usually packages that include cyclones and other related pieces.

#### Buildings and Storage

Buildings vary considerably among dehydrating establishments, depending on individual desires, local conditions, and construction material. Covers to shield grinding and pelleting equipment and to protect the finished product are mandatory. The drying drum and forage feeder may require shelter in areas of very inclement weather.

#### Working Capital

Provision must also be made for

a substantial amount of working capital. Ordinarily, an amount must be included to take care of expenses until returns from sales can carry the burden.

Because of future uncertainties for a new dehydrating enterprise, the length of time working capital may be needed should be estimated on a liberal basis. Some members of the dehydrating industry who have started new plants advise that a newcomer should be prepared to operate at a loss the first year.

#### Production and Marketing Costs

The types of costs in producing and marketing dehy are fixed and variable (table 4).

Table 4.—Estimated costs to produce and market dehydrated alfalfa based on case studies of cooperative plants having an output of 10,000 tons a season

Cost item	Estimated cost		Cost for local situation	
	Total	Per ton	Total	Per ton
	Dollars	Dollars	Dollars	Dollars
<b>Fixed</b>				
Depreciation				
Buildings				
Mill	4,900	.49		
Office	100	.01		
Storage	1,000	.10		
Equipment				
Cutters and trailers	5,700	.57		
Trucks	4,900	.49		
Plant	14,800	1.48		
Office	200	.02		
Salaries				
Manager	6,600	.66		
Office	1,400	.14		
Taxes	5,500	.55		
Insurance	8,100	.81		
Interest	12,500	1.25		
Other costs				
Payroll taxes	400	.04		
Compensation insurance	100	.01		
Licenses	200	.02		
Legal and audit	1,600	.16		
Office supplies	400	.04		
Contributions and dues	200	.02		
Telephone	700	.07		
Organization expense	200	.02		
Miscellaneous	400	.04		
Total	69,900	6.99		
<b>Variable</b>				
Harvesting				
Labor	19,300	1.93		
Payroll taxes	1,400	.14		
Compensation insurance	1,800	.18		
Gasoline and oil	2,700	.27		
Maintenance and repairs	6,800	.68		
Total	32,000	3.20		

(continued—)

Table 4—(continued)

<b>Trucking</b>					
Labor	12,700	1.27			
Payroll taxes	700	.07			
Compensation insurance	800	.08			
Gasoline and oil	8,100	.81			
Maintenance and repair	6,300	.63			
Total	28,600	2.86			
<b>Processing</b>					
Labor	29,500	2.95			
Payroll taxes	2,200	.22			
Compensation insurance	1,500	.15			
Fuel	40,500	4.05			
Electricity	16,700	1.67			
Maintenance and repairs	22,500	2.25			
Total	112,900	11.29			
<b>Purchasing</b>					
Alfalfa	105,000	10.50			
Anti-oxidant	5,200	.52			
Laboratory service	500	.05			
Total	110,700	11.07			
Total variable production cost	284,200	28.42			
<b>Marketing</b>					
Storage and handling	11,500	1.15			
Freight-out <sup>1</sup>	35,000	3.50			
Brokerage and Commission	4,600	.46			
Advertising	300	.03			
Total marketing cost	51,400	5.14			
Total variable cost	335,600	33.56			
Total—all costs	405,500	40.55			

<sup>1</sup> This will vary among firms, depending upon location of plant, proportion of product sold in local area and to central markets, and percentage hauled by local buyers.

### Fixed Costs

Fixed costs do not change with volume of production. Generally, they are directly related to the amount of investment in facilities. Fixed costs are as follows:

*Depreciation.*—Depreciation is a charge for using up physical facilities.

It is a means of recapturing investment through the proceeds from production. The amount of depreciation depends upon: (1) value of depreciable assets, (2) useful life of the asset, and (3) method of depreciation.

Most dehydrating plants use the straight-line method of depreciating

assets. Annual depreciation rates for selected major cost items are:

Item	Yearly range of write-off Percent
<b>Buildings</b>	
Plant	4.0 – 10.0
Office	2.5 – 10.0
Warehouse	2.5 – 10.0
Storage tanks	5.0 – 10.0
<b>Equipment (field)</b>	
Cutters	10.0 – 33.3
Trailers	10.0 – 50.0
Tractors	10.0 – 33.3
Trucks	10.3 – 33.3
<b>Equipment (plant)</b>	
Forage feeder	5.0 – 20.0
Drum	6.7 – 33.3
Grinder	10.0 – 33.3
Pellet mill	10.0 – 25.0

Although depreciation rates for various types of equipment vary, total depreciation closely agrees. Among dehydrating plants, total depreciation averaged about 30 percent of fixed costs and 7.5 percent of total investment in facilities.

*Salaries.*—Salaries paid managers and other fixed administrative expenses generally have a direct relationship to investment in facilities.

*Taxes.*—Property taxes generally depend upon the assessed value of property and the rate levied. Locations outside city limits usually have lower tax rates than those within.

*Insurance.*—Insurance costs usually cover fire and other hazards. Since alfalfa meal is combustible and plants are usually located out of range of good fire protection, rates applicable to dehydrating plants may be high. The amount of insurance needed will depend on value of assets and rate applicable to a specific location.

*Interest.*—Interest expense is charged against money borrowed from commercial lending institutions for buying facilities and providing for

working capital. Although interest is seldom charged against owner capital invested in the enterprise, it is a legitimate charge since it represents the amount foregone by not investing elsewhere.

*Other Costs.*—Included among these are payroll taxes and compensation insurance associated with fixed salaries, professional fees for legal and auditing services, contributions, and dues. Telephone charges may be treated as either a fixed administrative cost or a selling expense.

Expenses to organize the business are often spread out over the lifetime of the facility at a fixed annual rate.

### Variable Costs

Certain costs vary with production volume. A few such as purchases of raw materials are closely related to output. But some expenses, including labor, may be rather loosely tied to output. These have been classified as variable costs.

*Harvesting.*—Almost exclusively, dehydrating firms do their own harvesting. This involves using specialized and relatively expensive machinery.

*Labor* cost for each ton harvested is determined by: (1) wage rate, (2) amount of overtime, (3) hours worked and, (4) yield of alfalfa per acre. The average is about one man hour for each ton of dehy produced.

*Payrol taxes* include employer's expenses for Social Security.

*Compensation insurance and Unemployment Compensation* represents employer's contributions to insure employees for work-connected injury and illness.

*Gasoline and oil* costs depend on price per unit of fuel (gasoline, diesel, LP gas, etc.) and volume used. The volume used per ton depends on:

(1) yield, (2) terrain, and (3) size and efficiency of equipment. On the average, slightly more than one gallon of fuel is required per ton of dehy.

*Maintenance and repair* expenses occur in keeping machines in good operating condition. The amount of such costs depends on condition of equipment, skill of operator, field conditions, and general over-all maintenance policy.

*Trucking.*—Hauling wet chops from field to the processing plant is done by company drivers in company trucks.

*Labor* costs per ton of dehydrated alfalfa depend on: (1) wage rate, (2) hours worked, (3) premiums paid for overtime, (4) distance between plant and field, and (5) size of load. Truck labor costs will average about three-quarters of a man hour per ton of dehy produced.

*Payroll taxes* are determined by amount of wages paid to truck drivers.

*Compensation insurance* represents employer's expenses to insure employees for work-connected injury and illness.

*Gasoline and oil* costs for operating trucks depends on unit price and quantity used. On a per ton basis, quantity used depends on distance traveled, road conditions and size of load. About 3 gallons per ton of dehy is average.

*Maintenance and repair* costs depend on condition of equipment, operator skill, road conditions, and general over-all policy.

*Processing.*—The processing phase of alfalfa dehydrating is automated. An operator mainly regulates equipment and controls material flow. Other employees may be needed at a large plant or one without central controls.

*Labor* costs for a plant depend on rate of pay and hours worked. Cost

per ton depends on total wage payment and production volume. Volume is a factor not always steady. Labor for processing will average about one man hour per ton of dehy.

*Payroll taxes* are determined by amount of wages paid for plant labor.

*Compensation insurance* represent employer's expenses to insure employees for work-connected injury and illness.

*Fuel* costs for dehydrating depend on cost per unit of fuel (natural gas, oil, etc.) and quantity consumed. Efficiency of operations and moisture content of raw alfalfa largely determine quantity of fuel used. Natural gas usage will range from 9,000 to 15,000 cubic feet a ton and will average about 12,000 cubic feet a ton.

Fuel is also used for heating water in the boiler.

*Electricity* is used for running motors. Costs for electricity depend on rate and amount of electrical energy used. Electricity used per ton of production will range from 60 to 140 kilowatt hours and average close to 100 kilowatt hours.

*Maintenance and repair* costs depend on equipment conditions, operator skill, and general policy.

*Purchasing.*—The cost of raw material, additives, and other purchases must also be considered in evaluating the feasibility of a proposed plant.

The cost of alfalfa (raw material) will vary by locality, cutting, and season. In 1967, average costs of alfalfa ranged from about \$10 a ton (dry weight) at mid-western plants to \$18 a ton at West Coast plants. Variations by cutting were also quite substantial. At one plant, for example, the first cutting cost \$8 a ton and the fourth \$14 a ton compared to an average of \$10 a ton for the season. Seasonal price changes may be quite



Tanks such as those shown are used to store dehy pellets in an inert gas atmosphere to preserve nutrients.

substantial especially if alfalfa production fluctuates.

Treating dehydrated alfalfa with a chemical antioxidant is a widespread practice in the industry. It is a recommended procedure for a new establishment regardless of whether inert gas storage is available.

The addition of fat to alfalfa meal for reducing dust is no longer necessary. Modern processing, especially pelleting, eliminates the dust problem.

A few plants still bag some meal and where practiced, bags would be an additional material cost not shown in the table. Most dehy is handled in bulk.

*Services* include having dehy tested for protein and carotene content by commercial laboratories.

*Marketing.*—This includes all ex-

penses incurred in getting dehy to customers.

*Storage and handling* are the costs to store dehy and handle it in and out of storage. A generally accepted cost for storing in an inert gas atmosphere is \$1 per ton per month. Handling in and out of storage cost about \$1 per ton.

*Freight-out* expense generally relates to rail shipments, but movement by trucks may also be involved. Freight costs are based on zone rates. Information on costs from a particular point to a destination may be obtained from the nearest rail freight office. Rates are subject to change from time to time.

Some plants may have delivery expenses to local or area buyers. A few dehydrating plants sell all or al-

most all of their product within 100 miles or so of their installation. Delivery costs for those plants would be substantial. Estimates of local area delivery costs may be obtained from truckers.

*Brokerage and commissions* are fees charged by middlemen for selling dehy. Such charges average \$1 to \$1.25 a ton.

Sales in increasing amounts are being made through direct contact between producers and buyers. A few large firms have their own salesmen. At small and moderate sized plants, part of the manager's time is used to make sales. Determining sales cost under this circumstance is a matter of allocating managerial salary and travel in proportion to his sales effort compared with other duties.

*Advertising* costs among dehydrators, in most cases, are limited. In making local sales, however, it may be necessary to increase the scope and expenditures for advertising.

### Total Costs

The total seasonal costs for a selected group of co-op plants was \$405,500, or \$40.55 a ton. Variable costs accounted for nearly 83 per cent of the total.

It must be emphasized that these costs relate only to these organizations and to the conditions under which they were operating.

For any given plant, the cost of producing and marketing dehy will depend in large part on the rate and volume of output. These plants, for example, could have produced 10,000 tons of dehy (1) by having an average output of 3.5 tons an hour and operating 120 (24 hour) days, or (2) by having an average output of 3 tons an hour and operating 140 (24 hour) days. At approximately

\$3,000 a day, the cost would be \$6 more a ton for the longer operating period.

Varying rates of output and number of operating days also result in different volumes of dehy produced during a season. Our example plant could have produced more or less than 10,000 tons. A higher production would have resulted in greater total costs but a lower cost per ton.

Plants that are identical in every respect, except location, also have different costs. Rates for fuel, electricity, gasoline, labor and other items vary from place to place. The cost of raw alfalfa also varies. These variations affect both total costs and the cost per ton. Thus some locations or geographical areas appear to have advantages that enable low cost production of dehy.

Geographic advantages do not explain all the differences in costs among the various dehy producing areas of the United States. The major factor is the ability of a plant to achieve a high daily output average and to keep the production volume up during a season. The Platte Valley area of Nebraska has this ability.

Total costs and cost per ton are also affected by economies of scale. For example, a plant with twice the capacity of another facility has less than double the fixed cost. In addition, the larger plant often gets greater discounts for gas, electricity, and other items. A larger plant can also fully utilize its labor.

Although economies of scale are present in dehydrating operations, plant capacity does not appear to be a decisive consideration in dehy production costs. A recent publication showed that a few small plants that had adequate and consistent alfalfa supply produced almost as efficiently as the large plants (6).

Montana researchers in an unpublished 1966 study found little relationship between plant capacity and the cost to produce a ton of dehy. However, their data showed that per ton costs were closely related to the percentage of plant capacity used.

## Prices

Dehy market prices are determined competitively. The demand schedule is relatively inelastic and stable. This means that a change in price has little effect on volume of sales.

Average annual prices of dehydrated alfalfa on the Kansas City market have generally ranged between \$40 and \$50 a ton since 1953. Although there are exceptions, years of relatively high average prices generally coincided with years in which disappearance exceeded the produc-

tion of dehy. Conversely, lower prices usually occurred when production was greater than disappearance.

Ordinarily prices are lower in the summer during dehydrating operations than during the winter months. Exceptions occur when unusual supply-demand situations exist. For example, prices did not peak in the winter months of early 1968 but continued a decline that began in March 1967.

Prices of dehy are quoted at a number of markets in the United States. Table 5 gives an excerpt listing from Feed Market News, a publication by Consumer and Marketing Service, USDA. These lists identify the markets and indicate roughly the price relationship among them. The price spread from one market to another is influenced largely by transportation costs from the main supply area.

**Table 5.—Prices of dehydrated alfalfa for selected periods at various markets**

Feedstuffs and Markets	July 23 1968	July 16 1968	July 25 1967
<b>Dehydrated Alfalfa Meal</b>			
(Reground pellets)			
Alfalfa Center (pellets)	27.70	28.20	40.50
Baltimore	49.50	51.20	59.10
Boston	47.50	48.00	61.00
Buffalo	44.80	44.80	57.60
California Mills	53.00	53.00	58.00
Chicago	40.00	40.00	52.20
Cincinnati	46.00	46.00	55.40
Denver	37.50	37.50	44.50
Ft. Worth	40.10	40.80	51.20
Kansas City	34.50	35.50	48.00
Los Angeles	53.00	53.00	55.50
Memphis	40.00	41.00	50.00
Minneapolis	38.50	38.50	50.00
Portland	66.50	66.50	60.60
St. Louis	39.00	39.00	51.00

Source: Feed Market News, Consumer & Marketing Service, U.S. Department of Agriculture, July 24, 1968.

**Table 6.—Estimated sales proceeds, net returns, and plant layout periods at three levels of sales prices for an alfalfa dehydrating plant with an output of 10,000 tons a season**

Price and operating items	Estimated results		Local situation	
	Total	Per ton	Total	Per ton
	Dollars		Dollars	
Sales at \$40 a ton				
Sales proceeds	400,000	40.00	_____	_____
Production and marketing costs	405,500	40.55	_____	_____
Net returns	(-5,500)	(-0.55)	_____	_____
Plant payout in years <sup>1</sup>	—	X X	_____	X X
Sales at \$45 a ton				
Sales proceeds	450,000	45.00	_____	_____
Production and marketing costs	405,500	40.55	_____	_____
Net return	44,500	4.45	_____	_____
Plant payout in years <sup>1</sup>	8.5-9.4	X X	_____	X X
Sales at \$50 a ton				
Sales proceeds	500,000	50.00	_____	_____
Production and marketing costs	405,500	40.55	_____	_____
Net returns	94,500	9.45	_____	_____
Plant payout in years <sup>1</sup>	4.0-4.4	X X	_____	X X

<sup>1</sup> Based on total investment in plant, equipment, storage, buildings, and land ranging from \$377,515 to \$419,165. The rate of payout would be much faster if cash available from the annual depreciation amounting to \$30,700 a year was used for this purpose. If 50 percent of the cost is borrowed, the payout on the loan would be one-half of the period indicated for the entire investment.

## Sales Proceeds and Net Returns

Average annual prices of dehy at Kansas City in the last 15 years ranged between \$40 and \$52 a ton.

Table 6 shows the sales proceeds and net returns that would result from a 10,000 a year plant based on sales at three price levels, and at costs shown in table 4.

Also, it shows the number of years required to pay for the plant at the three net return levels.

## Break-Even Analysis

Total returns from marketing cannot be accurately predicted because of the uncertainty of production vol-

ume, sales volume, and prices. Year to year production at individual plants vary, sometimes considerably. Prices sometimes fluctuate substantially. Because net returns from operations are quite variable financing through borrowing must be approached carefully.

Break-even analysis is one way of determining borrowing ability. The analysis uses relationships between variable costs and prices to determine the production (and sales) volume needed to cover fixed costs, as follows:

### Fixed costs

Price per ton - variable cost per ton  
= break-even volume

Using table 4, total fixed costs are \$69,900 and variable costs are \$33.56

a ton. The production required to break-even depends upon prices received during the year.

In table 6, three different prices were used to calculate plant payout in years. They are used here as examples of price possibilities a plant may encounter, depending upon general supply-demand conditions during a given season.

At the lowest price (\$40 a ton), the volume required to cover both fixed and variable costs would be:

$$\begin{array}{r} \$69,900 \\ \$40.00 - \$33.56 \\ \hline = \$69,900 \\ \$6.44 \\ \hline = 10,858 \text{ tons to break even} \end{array}$$

If the plant's realized production was only 10,000 tons, it would fall short of the needed volume to cover fixed costs by 858 tons.

Had there been no interest expense of \$12,500, fixed costs of \$57,400 would be covered by 8,923 tons of production and sales.

At \$45 and \$50 a ton, the break-even volumes (fixed costs at \$69,900) would be 6,110 and 4,252 tons, respectively.

But price is not the only variable that must be considered. Production volume also varies with daily output and the number of working days in a season.

The plant we are using as an example had an indicated dry output capacity of 3 to 4 tons per hour and an estimated season's production of 10,000 tons. This stated capacity range allows only for moisture variations. If the 4-ton-per-hour rate could be maintained, 10,000 tons could be produced in 105 days. The 3-ton-per-hour rate would require 139 days. Both of these assume 24-hour days.

However, if short interruptions, inadequate supplies of alfalfa and the

like occur with some frequency, actual output may average 3 tons or less an hour. Average outputs of 2½ and 2 tons an hour would extend the number of days required to produce 10,000 tons to 168 and 230 days, respectively.

Estimating production volume for the season necessarily depends upon expected rate of output per hour or day and the number of working days anticipated during the season. With a plant capacity of 3 to 4 tons per hour, 3 tons might well be the upper limit for estimating, depending upon local circumstances. And given a usual length of season, it should be recognized that a certain number of days will be lost.

For example, assume (1) that the 3 to 4 tons per hour plant can reasonably expect to average 2¾ tons per hour or 66 tons per day and (2) expect to operate during a 180 day season, but planned or unplanned non-working time amounts to 40 days. The 66 tons per day for 140 days gives 9,240 tons as an estimate.

Given these production estimates and costs as previously used, the price needed to break even is found as follows:

$$\begin{array}{l} \text{Fixed cost} \\ \text{Estimated production} + \text{variable} \\ \text{cost} = \text{price needed to break even} \\ \text{or} \\ \frac{\$69,900}{9,240} + \$33.56 = \$41.12 \end{array}$$

A price higher than \$41.12 would be required to realize positive net returns from operations.

If there were no \$12,500 interest expense involved, the price needed would be reduced to \$39.77.

## Markets and Market Development

Although it is a manufactured product, dehy marketing is similar to

that for unprocessed agricultural commodities, especially grains. Dehy is graded and competitive prices for it are quoted on a number of commodity markets. Most of it goes to market in bulk—either in pellet or re-ground pellet form—and by rail.

It moves through three general channels: (1) directly to feed manufacturers, (2) through middle men, mostly brokers who charge a commission for their services, and (3) in feed mixes of manufacturers that have their own dehydrating facilities.

Direct selling of dehy from producer to feed manufacturer is the most important method of marketing the product. A few firms have their own sales organizations to promote their product. At a number of plants, the plant manager divides his time between supervising production and making sales.

Direct selling, and especially personal contacts, have been relatively successful. They keep suppliers in touch with the recurring needs of es-

tablished customers. But some industry leaders have indicated that new users are not being recruited fast enough to keep pace with production growth.

Using middlemen to bring buyers and sellers together is convenient for dehy producers who have no sales organization. However, the method does not effectively discover potential demand. Brokers who handle dehy generally handle other materials also. Dehy may represent only a minor part of their operations. Under such circumstances, their sales are mainly to ready buyers. They are thus essentially order takers not order makers.

### Domestic

In the 1967-68 marketing season, 87 percent of the dehy production was used domestically—72 percent by feed manufacturers and 15 percent by livestock feeders. This distribution differs from that of 1954 when feed manufacturers accounted for 93 per-

Since most dehy goes to market in bulk—either in pellet or re-ground pellet form, ducts such as shown here are used to blow the material from the storage tanks to rail cars or trucks.



cent of the dehy sales and 7 percent to livestock feeders.

Opportunities for further developing the U.S. market for dehy may be present, but cannot be guaranteed. Although the current surplus of dehy indicates market saturation, weak marketing may be a part of the explanation. Recent efforts within the dehydrating industry to obtain sales representatives with a background in animal nutrition are intended to strengthen the marketing process.

Most large feed manufacturers in the United States use dehy in some of their mixes. Generally, its use is based on recommendations of their own nutritionists. They determine what mixes should include dehy and the level of use in a formula. In this situation, neither sales persuasion nor lowered prices have much affect on the amount of dehy used.

Undoubtedly many small feed manufacturers use little or no dehy. Expanding dehy sales among such manufacturers will require effective marketing efforts.

### Local

The local market includes: (1) sales at the plant to buyers who haul the product in their own vehicles and (2) sales delivered to buyers in trucks owned by the dehydrating firm or by independent truckers.

The area covered by a local market varies. Distance is one limiting factor. Another is competition. Generally, the trade territory extends to where the delivered price of the product is about equal to product prices from other sources.

Local sales may be to feed manufacturing firms and to livestock feeders. Ability to sell to feed manufacturing plants may depend on the kind of feed they manufacture. The importance of including dehy in differ-

ent rations is greatest for poultry, less for cattle and sheep, and least for swine. Selling to feed plants heavy on swine mixes would require the most sales effort.

Selling dehy to local livestock feeders may be relatively easy or difficult. For feeders using dehy, the matter may be simply one of offering as good a product at a lower price than they are paying. It may be necessary, however, to educate non-users.

A local area may provide more opportunity for development than either the foreign or domestic central markets. Various leaders of the dehydrating industry have recommended concentrating on local market penetration during the first few years of operation. The recommendation is appropriate under present conditions.

Developing a local market requires information on how large an area is to be served. A method for determining the market area is described in the report on feasibility of establishing a dehydrating plant at Sidney, Mont. (3)

Briefly, the method consists of adding freight costs to the estimated costs of producing a ton of dehy to arrive at a selling price. Comparing this price to those quoted at the nearest major markets will help to decide which markets to serve.

Another method for determining the potential market area is to contact all users within the proposed operating area and determine if they would purchase from a new supplier at competitive prices and at possibly lower prices. It is also necessary to determine if the quantity they expect to use is enough to support the enterprise. Potential customers include feed manufacturing concerns and livestock feeders, especially those having cattle and/or sheep operations.

In recent years, some plants have depended almost entirely on sales to

livestock feeders. Estimating sales to livestock feeders requires determining the animal population within the market area. A beginning may be made by assuming limits within a 100 mile radius of the plant. Given the limits, an idea of livestock numbers may be obtained from the State department of agriculture. Applying a modest per head usage of alfalfa to the population of animals will give a potential volume of dehy sales (7).

Developing a market among feeders who are not constant users of dehy will require a thorough knowledge of animal needs and the sources from which those needs can be supplied. A good selling job, then, can be enhanced if salesmen have a thorough background in animal nutrition and make the personal contacts needed to convert new users to the product. The same also applies to feed manufacturers that operate without the services of a nutritionist.

### Foreign

An export market has developed for dehy during recent years. Thirteen percent of the 1967-68 production was exported. The biggest customer is Japan, but Europe and other parts of the world also take some dehy.

Most of the dehy shipped to Japan is produced in and exported from California. Some production from the interior section of the United States enters foreign trade through the Great Lakes and Gulf ports via Missouri-Mississippi River barges.

Japan has a rapidly expanding

mixed feed industry and must import all its dehy. A few European countries have dehydrating facilities which compete with imports from the United States.

Japanese feed manufacturers operate under a very tight cost-price squeeze which limits the volume of dehy they can use and the price they can pay. When the price of dehy increases, users turn to substitutes, including sun-cured alfalfa meal.

A new dehydrating enterprise that wants to move into foreign trade must be located with low cost access to a port. Overland hauls are expensive.

If location is favorable, developing a foreign market will require adequate finances, foreign trade experience, and organized selling effort. A new plant may associate with an existing export marketing company to get the desirable know-how and organization. This may not be easy, especially under current conditions of excess supply.

Successfully serving a foreign market will involve a large-scale dehydrating operation. Uncertainties of foreign demand for dehy suggest that export sales should be only a part of a firm's total volume of sales. However, effective promotion of the product abroad generally requires personal contact with potential customers by representatives who have technical training in animal nutrition. Because travel and sales personnel are costly, a sizeable volume of sales may be needed for an export program to pay off.

## Industry Problems

Cooperators who contemplate establishing a dehydrating facility should be aware of some problems

currently facing the industry. These include (1) a large inventory carry-over at the beginning of the 1968-

69 season, (2) changed feed mixing practices, (3) excess capacity, and (4) production and marketing uncertainties.

### Excess Carry-Over

The total supply of dehy available during a marketing year (May through April) consists of production during the period plus carryover from the preceding period.

For the 1967-68 season, U.S. production of dehy was 1,620,800 tons; stored carry-over April 30, 1967, was 108,200 tons.<sup>2</sup> Total supply for the period was 1,729,000 tons and disappearance amounted to 1,514,200 tons. Storage on hand April 30, 1968, was 215,000 tons, a carry-over considerably above normal.

For the 1968-69 season, U.S. production of dehy was 1,582,400 tons; stored carry-over April 30, 1968, was 214,800 tons. Total supply for the period was 1,797,200 tons. A disappearance of 1,655,900 tons left a carry-over on April 30, 1969, of 141,300 tons.

As a result of the lower carry-over beginning the 1969-70 season, dehy prices were about \$7 higher than they were at the beginning of the previous period. Other year to year production-disappearance relationships are shown in Figure 6.

The large carry-over of dehy at the beginning of the 1968 season presented a marketing challenge to the industry. This was not a new problem, but it was a bigger and probably more persistent one than usually occurs. Such occurrences have tended to intensify marketing activity in the industry.

Periodic intensification of marketing activity have usually increased sales. However, such efforts alone have not erased surpluses. Ordinarily they have been aided by production adjustments brought about by a period of poor production conditions or by a cut back in capacity. The latter has occurred when plants have been too weak financially to survive periods of lower prices.

Leaders in the industry recognize that the 1968-69 surplus is not likely to work itself out as readily as on previous occasions. A few believe that current market practices will not soon remedy the situation.

Salesmen with thorough technical knowledge of annual nutrition can improve sales. This means recruiting sales personnel who already have good background, additional training of people now engaged in selling dehy, or both. The merit of these approaches is that the main potential for sales appears to be among feed manufacturing plants and livestock feeders who do not employ their own nutritionists and could use advisory service.

### Changed Feed Mixing Practices

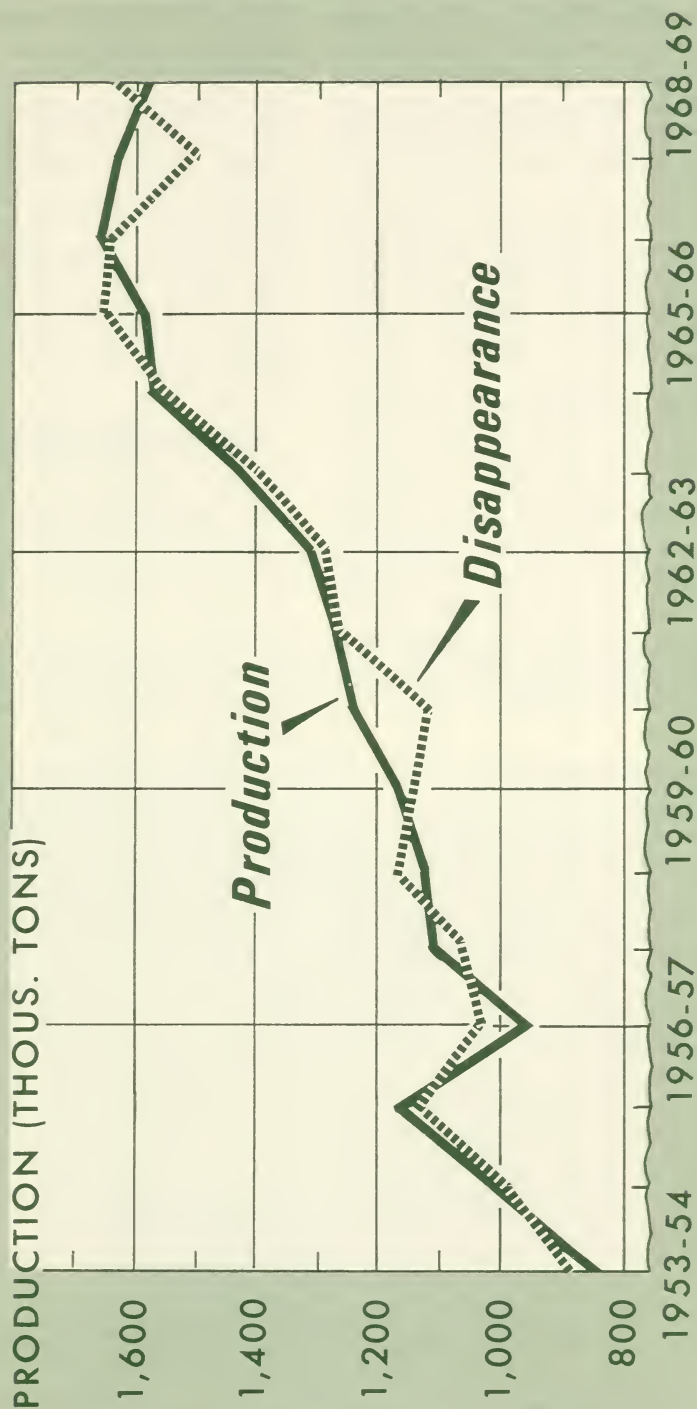
Feed manufacturers have changed their mixing practice with dehy. Because of indefinite knowledge of animal and poultry nutritional requirements, many formulators before 1964 customarily included more than specified for a mixture to provide a margin of safety.

The questionable stability of a few nutrients in dehy may also have contributed to the practice. With improved information on nutritional requirements and widespread dehy preservative treatment, mixers have generally ceased adding the safety margin.

---

<sup>2</sup> U.S. Department of Agriculture, Consum. & Mktg. Serv., distributed by American Dehydrators Association, July 1969.

**FIGURE 6.--ANNUAL PRODUCTION AND DISAPPEARANCE  
OF DEHYDRATED ALFALFA, UNITED STATES**



SOURCE: AMERICAN DEHYDRATORS ASSOCIATION INFORMATION CHARTS  
DERIVED FROM USDA REPORTS, 1968.

As a result of the change in mixing practice, the ratio of dehy in mixed feed rations has declined. Formerly, that portion of dehy tonnage going to feed manufacturing was nearly 3 percent of mixed feeds produced. The prevailing ratio now is close to 2 percent.

The demand for dehy is closely related to feed manufacturing activities. As annual volume of manufactured feed changes, the amount of dehy needed similarly increases or decreases.

Present indications are that future expansion of marketing dehy to feed manufacturers will depend largely on growth of the formula feed industry. Those who include dehy in their mixes represent the bulk of formula feed production and their level of use appears to be fairly well set. Generally, each 100,000 tons expansion in manufactured feed production will use 2,000 tons of dehy.

### Excess Capacity

With the existing drying capacity, the alfalfa dehydrating industry could annually produce much more dehy than it does. Because of varying and sometimes unfavorable environmental conditions, erratic alfalfa supply, interruptions, and other similar reasons, many plants fail to realize full production capabilities.

In an unpublished study, for example, Montana researchers reported that only one of 20 plants operated at 100 percent capacity in 1966. Four operated at less than 50 percent of their capacity.

The excess capacity is involuntary and unavoidable. Probably it is also permanent, but the industry currently operates closer to capacity than it did 10 to 15 years ago.

With a given total capacity for

the industry, the volume of dehy produced fluctuates, depending on whether favorable or unfavorable operating conditions prevail. Occasionally, industry production volume falls short of, or exceeds, expectations.

Dehy price is sensitive to small changes in supply of the product. Higher prices result from relatively low production, especially when coupled with a light carryover. Lower prices result from relatively high production, especially during a heavy carryover year.

### Production and Marketing Uncertainties

However carefully the feasibility of a new dehy plant is studied and regardless of the detail with which cost and return estimates are made, operating results will be uncertain. Even a well established plant, although it may have operated for years, begins each new season with production and marketing uncertainties.

A plant manager or operator cannot predict, with confidence, how much dehy his plant will produce during a season. Production volume will depend on how much alfalfa is available and the number of working days.

Similarly, a plant manager or operator cannot accurately predict what prices his dehy will bring or how much he can sell during a season. He may get some idea of short run prospects by the size of carryover from the preceding year. He may also be able to anticipate seasonal changes. By year's end, however, the effective influence on dehy prices will be determined by industry-wide production during the season.

### Prospects Through 1970-71

During the 1968-69 season, dehy disappearance attained the second

highest level on record—exceeded only by the 1,658,500 tons for 1965-66. From May through October 1968, dehy disappearance amounted to 810,400 tons or nearly half that for the entire year. For the same period (May-October) in 1969, usage was 980,600 tons. If this rate is maintained comparable to the preceding period, disappearance for 1969-70 would be more than 1,900,000 tons.

Production of dehy from May through October of 1968 was 1,480,400 tons or 93 percent of the 1968-69 total. In the same period of 1969, dehy production amounted to 1,618,200 tons. If this, too, is 93 percent of total, dehy production for 1969-70 will be 1,740,000 tons. Add to that total the tons of dehy in storage on May 1, 1969, and total supply dur-

ing the period ending April 30, 1970, will be about 1,881,300 tons.

The forecast for disappearance is about 20,000 tons higher than is the one for total supply. Possibly winter production of dehy could be high enough to make up the difference. It is more probable, however, that the rate of disappearance will slow down due to producers holding back in anticipation of price increases and/or users resisting higher prices.

Dehy in storage on April 30, 1970, will almost certainly be lower than it was a year earlier. Prices to begin the 1970-71 season should be higher than at the beginning of the 1969-70 year. What prices will be from that point depends on the supply-disappearance relationship established during the months of highest production.

Because of varying and sometimes unfavorable environmental conditions, erratic alfalfa supply, interruptions, and other similar reasons, many plants, similar to the one shown here, fail to realize full production capabilities.



# Guidelines for Establishing Alfalfa Dehydrating Cooperatives

The following guidelines for establishing a cooperative alfalfa dehydrating plant are based on accumulated experience of cooperatives in

the dehydrating business. Each point is discussed in detail in other portions of this publication. (See contents for exact page numbers.)

## Alfalfa Supply and Market

Study the proposed establishment of a dehydrating plant carefully and in detail.

1. Determine if sufficient alfalfa is available to keep proposed plant running.

2. Be certain there is a market for the product—in volume and at prices required for adequate net returns. While there is currently excess capacity in the industry local outlets may be available.

3. Make best possible estimates of investment requirements and operating costs.

4. Install no more capacity than indicated by alfalfa supply or by quantity of meal that can be marketed—whichever is smaller. It is better to start small and have healthy growth than start big and operate only part time.

5. Be prepared to compete successfully with other firms in marketing, and this includes developing markets.

## Location

Choose a good location in the general area of operation.

A desirable area includes:

1. Fertile, well drained soils provide good alfalfa yields and favorable working conditions. Generally, yields of less than 2 tons per acre for a season are undesirable. Heavy clay soils are unworkable when wet and stay

wet for long periods of time. Extreme sandy soils may drain too rapidly for alfalfa to get the moisture it needs.

2. Adequate moisture preferably supplied by irrigation or from reliable sub-terranean sources. Relying on rainfall alone is usually unsatisfactory. It may provide too little moisture, or be improperly distributed throughout the growing season.

3. Relatively mild temperatures foster growth and quality of alfalfa. Day time temperatures averaging between 70° to 95° Fahrenheit are preferable.

4. A season long enough to provide three and preferably four or more cuttings. A short season does not allow sufficient volume to cover overhead expenses with margins that usually prevail between price and cost.

A desirable site has:

1. Central location to alfalfa supply to reduce hauling expenses.

2. Inexpensive fuel available, natural gas in most cases.

3. Adequate shipping facilities.

## Initial Financing

Provide sufficient funds to pay for facilities and to carry operations until satisfactory returns can be realized. As a general rule, members should invest in the proposed facility in proportion to acreage.

Additional capital may be raised

by selling preferred stock to members and others. Financing through borrowing should be approached cautiously. Returns from dehydrating operations fluctuate substantially.

The odds are that a new plant will operate at a loss the first year. The level of borrowing should therefore reflect this possibility and provisions should be made for obtaining supplemental financing. When operations provide sufficient returns, reserves should be set aside for expansion, improvements, and contingencies. Co-operative and other type plants have suffered from failure to provide for growth, inability to adopt innovations, and unexpected set backs.

### Plant Efficiency and Stability

Be certain of grower cooperators—of their intentions to grow alfalfa on a long term basis and to accept conditions required to accomplish economy and quality in dehydrating.

With present technology, dehydrating requires cutting at an early stage of maturity to get quality material. Shown here is one of the latest pieces of field equipment using high-flotation wheels to safeguard field conditions.

The size of the dehydrating unit will depend on the number of grower-members. If there are too few members, for example, five, the unwillingness or inability of one to supply alfalfa to the plant may seriously reduce the volume of dehy produced. Probably no individual grower should supply more than 10 percent of the plant's alfalfa.

An upper limit on the number of grower-members depends on the size of alfalfa fields and the distance from the proposed plant. Smaller fields are the most expensive to harvest. And the farther they are from the processing plant, the greater the hauling expense.

Generally, there is little advantage gained in cutting fields of less than 10 acres or those more than 10 miles from the plant. Perhaps a half dozen or so such fields in the cutting rotation would present no problems. However, fields averaging 20 acres and more in size and within a 10-mile radius of the plant are preferred and



should receive primary consideration in determining the number of grower-members.

### Producer-Co-op Contracts

Carefully consider the merits of using an agreement between the grower and the dehydrating cooperative that defines possible areas of conflicting interest. Agreements or contracts should be written and include:

1. A provision that the member-grower will supply alfalfa from a given acreage for a specific period of time or until relieved of the obligation by the cooperative dehydrating enterprise.

A condition may be set forth which will give the dehydrator ample time to procure an equivalent supply from another source. The agreement should also provide that the dehydrating plant will faithfully cut the grower's alfalfa and under appropriate conditions.

2. A provision regarding the time, or stage of maturity, at which alfalfa will be cut. A grower's natural inclination is to cut at a late stage of maturity to get greater tonnage.

With present technology, dehydrating requires cutting at an early stage of maturity to get quality material. Occasions arise when fields cannot be cut at the time agreed upon. The dehydrating plant should not be obliged to harvest the crop later and include it in its regular drying activities. There may be a stipulation which specifies that the plant will cut mature alfalfa but dispose of it some other way; that is, by making suncured pellets or baling the material.

3. A provision that the dehydrating plant must safeguard field conditions. This involves using high-flotation wheels on cutting equipment and generally not entering fields

when there is danger of causing ruts or otherwise tearing it up.

4. A provision on pricing. The general practice in the industry is to bargain for price, from cutting to cutting, as the local supply-demand situation indicates. This practice may serve as a basis for making cash payments to growers by the cooperative with the additional provision that patronage refunds will be made if justified.

Or, the cooperative can use a pooling arrangement either to spread risks equitably or as a means of aiding dehydrator financing (4). Under this plan, one or more cash advances can be made to growers during the processing season and final settlement made at the end of the operating period.

5. A provision for penalties in breach of contract by either growers or the dehydrator. Consider a contract for coordinating the production and marketing practices of growers with the processing requirements of the dehydrating operation.

### Management Team

The management team of a cooperative dehydrating plant includes its board of directors and a manager. The main functions of directors are to make policy and hire a manager. Both are important.

In his policy function, a director may emphasize his farm interest at the expense of his dehydrating interest since he probably has more invested in the farm than in the dehydrator. He therefore may make a decision that enhances his farm income but depletes the dehydrating resources.

A board decision to declare patronage refunds too often and in too large amounts in relation to net revenues from dehydrating operations must be

avoided. The director must have the ability to reconcile his farm interests and those of other member-growers with the long term objectives of the dehydrating plant.

Hiring a manager is a critical matter. Someone who has demonstrated managerial ability should be selected. If the manager has no dehydrating experience, the plant operator should have.

The qualifications of a manager will depend in part on whether the cooperative is a marketing agency formed by alfalfa growers or a supply agency established by a feed manufacturing cooperative.

A manager of a marketing cooperative must have an interest in selling. If the dehydrating plant is part of a feed mill, marketing may be a minor activity so a production oriented manager having supervisory capabilities may be satisfactory.

To get and keep a good manager requires that he be compensated adequately for his services. Generally, the manager should be paid on the basis of responsibilities associated directly with dehydrating.

The safest guide is to pay him what other managers in the industry of comparable responsibility and competence receive.

## Appendix: Methods of Making Estimates in a Detailed Study

A proposed alfalfa dehydrating plant would not have actual or recorded money outlays or income of its own. A detailed investigation can fill in the missing costs and returns

by reasonable estimates.

Three basic methods of estimating are: (1) comparison method, (2) survey method and (3) statistical method.

### Comparison Method

In the comparison method, financial records of an operating enterprise form the basis for making cost-income estimates for the projected venture. The balance sheet, income statement, and inventory of assets are the most useful documents for this purpose.

The comparison method is simple in use and principle. Items are selected from the financial records of a plant similar in size and operating environment to the one being considered. The method assumes that plants closely related in capacity and operating conditions have similar experiences. For example, two plants operating in the same locality have quite comparable raw material and fuel costs.

Care must be taken to use relatively current figures. Even this does not assure completely accurate estimates. There is at least one year's lag between the season for which records are available and the season to which an estimate applies. There may be considerable year to year variation within a given plant in cost and income, experience. The variation may be still greater when considering two separate plants involving different management, operating techniques, and skills. By using careful judgment, however, the comparison method results in quite useful estimates. It may be necessary to adjust recorded data

in light of the season to which it is being related.

### Survey Method

In the survey method estimates are made from information provided by contractors, suppliers, and customers. It is a method that provides up-to-date information.

Contractor's bids form the basis for estimates for building and other structural costs. Costs of equipment, transportation, and installation can be derived from price quotations.

Getting some estimates may require actual field canvassing. For example, it may be necessary to contact a number of growers to ascertain how much and at what price they may be willing to supply alfalfa for dehydrating. Livestock feeders and feed manufacturing plants may be surveyed to determine the quantities they would be willing to buy. If possible, firm commitments should be obtained.

### Statistical Method

In the statistical method units of measurements are developed such as hours of labor, and calculations made on the basis of these units. Here, the various elements of expense are divided into uniform units. The total cost of each unit is based on the cost per unit and the number of units needed in the proposed plant.

In estimating labor costs in harvesting, for example, it is necessary to determine how many units of labor are required and what rate of pay applies to each.

On the basis of alfalfa yield, size of cutters, and capacity of plant, it may be determined that two chopper operators will be used in the field during each 8 hour shift for 24 hour operations. This totals 48 man hours per 24 hour period. If the growing period for alfalfa is nearly 6 months, or 180 days, and 3 weeks elapse before cutting can begin, then the harvesting season is about 160 days. Operating on a 6-day week eliminates another 23 days. An additional 14 days may be lost because of inclement weather, thus leaving 122

harvesting days. Total manhours requirements for the seasons in 5,856 hours.

If labor costs \$1.50 per hour total labor harvesting cost is determined as follows:

Number of operating days	122
Man hours per day	<u>x 48</u>
Total man hours	
per season	5,856
Wage rate per hour	<u>x 1.50</u>
Total cost per season	\$8,784

If overtime pay rates are involved, they will have to be taken into consideration.

The statistical method can be used for making cost estimates of personnel, fuel, and the like. It can also be used in estimating some items of income.

## Literature Cited

- (1) Aamodt, O. S.  
1941. Climate and Forage Crops. U.S. Dept. Agr. Yearbook (Climate and Man), 1941:441—
- (2) Howard, William J.  
1944. Alfalfa Dehydration Plants. U.S. Dept. Agr., Mineo.
- (3) Luft, Leroy D.  
1966. Economic Feasibility of an Alfalfa Dehydrating Plant Near Sidney, Montana. Dept. Agr. Econ. and Rural Socio., Bozeman, Mont. Res. Rpt. 24, 58 pp.
- (4) Markeson, Clyde B.  
1959. Pooling and Other Grower Payment Methods as Used by Local Fruit, Vegetable, and Tree Nut Cooperatives. U.S. Dept. Agr. Farmer Coop Serv., Gen. Rpt. 67.
- (5) Mather, Warren  
1941. Dehydration of Alfalfa. Dept. Econ., Kansas State College, Mimeo.
- (6) Reed, Charles E.  
1962. Costs and Efficiency in Alfalfa Dehydrating Plants. Kans. Agr. Expt. Sta., Kansas State University, Manhattan, Kans. Tech. Bull. 124, 39 pp.
- (7) Reed, Charles E.  
1965. Establishing Dehydrated Alfalfa Plants in Kansas. Ext. Serv., Kansas State University, Manhattan, Kans. Cir. 325.
- (8) Reed, Charles E., Clifton, Ruth E., Schruben, Leonard W. and Cathcart, William E.  
1958. Marketing Dehydrated Alfalfa. U.S. Dept. Agr., Agr. Mktg. Serv. 83 pp.
- (9) Schoenleber, Leonard G.  
1950. Operations and Performance of Alfalfa Dehydrators in Central U.S. U.S. Dept. Agr. Agr. Res. Admin., Inf. Ser. No. 101.



## Other FCS Publications Available

**How to Start a Cooperative, Educational Circular 18.**

**Improving Management of Farmer Cooperatives, General Report 120.**

**Managing Farmer Cooperatives, Educational Circular 17.**

**Methods of Financing Farmer Cooperatives, General Report 32.**

**Sample Legal Documents for New Cooperatives, Information 66.**

**A copy of each of these publications may be obtained while a supply is available from—**

FARMER COOPERATIVE SERVICE  
U. S. DEPARTMENT OF AGRICULTURE  
WASHINGTON, D. C. 20250